

IBM System Storage SAN32B-E4



Installation, Service, and User Guide

Service information: 2498-E32

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IBM System Storage SAN32B-E4



Installation, Service, and User Guide

Service information: 2498-E32

Note:

Before using this information and the product it supports, read the information in "Notices" on page 55.

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Getting help

For the latest version of your product documentation, visit the web at www.ibm.com/shop/publications/order. Search by form number or title.

For more information about IBM® SAN products, see the following Web site: www.ibm.com/servers/storage/san/

IBM Redbooks® often provide in depth information about product best practices, configurations, and more technical information. For redbooks associated with this product, enter search terms on the following Web site: www.redbooks.ibm.com/.

For support information for this and other IBM products, see the IBM Support Portal, www.ibm.com/supportportal. Search for the product Machine type or product name.

For Fabric OS Release Notes and access to Fabric OS firmware downloads, go to the IBM Support Portal, www.ibm.com/supportportal. Search for the product Machine type or product name, and then follow links for **Downloads**. More detailed instructions are available through the **Accessing firmware updates and OS documentation updates** link on the product documentation CD that is shipped with this product.

You can also contact IBM within the United States at 1-800-IBMSERV (1-800-426-7378). For support outside the United States, you can find the service number at: www.ibm.com/planetwide/.

Visit www.ibm.com/contact for the contact information for your country or region.

For detailed information about the Fibre Channel standards, see the Fibre Channel Industry Association (FCIA) Web site at: www.fibrechannel.org/

For information about storage industry standards, see the Storage Networking Industry Association (SNIA) Web site at: www.snia.org/

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Accessibility features for the SAN32B-E4

Accessibility features help users who have a disability, such as restricted mobility or limited vision, to use information technology products successfully.

Accessibility features

The following list includes the major accessibility features in this product:

- Light emitting diodes (LEDs) that flash at different rates, to represent the same information as the colors of the LEDs
- Industry-standard devices for ports and connectors
- Management of the product through management applications is available through Web and Graphical User Interface (GUI) options

Keyboard navigation

This product does not have an attached or integrated keyboard. Any keyboard navigation is provided through the management software and GUI.

Vendor software

This product includes certain vendor software that is not covered under the IBM license agreement. IBM makes no representation about the accessibility features of these products. Contact the vendor for the accessibility information about its products.

Related accessibility information

You can view the publications for this product in Adobe Portable Document Format (PDF) using the Adobe Acrobat Reader. The PDFs are provided on a product documentation CD-ROM that is packaged with the product. The CD-ROM also includes an accessible HTML version of this document.

IBM and accessibility

See the IBM Human Ability and Accessibility Center web site at www.ibm.com/able/ for more information about the commitment that IBM has to accessibility.

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Safety and environmental notices

This section contains information about:

- “Safety notices and labels”
- “Rack safety” on page xix
- “Product recycling and disposal” on page xxi

Safety notices and labels

When using this product, observe the danger, caution, and attention notices contained in this guide. The notices are accompanied by symbols that represent the severity of the safety condition. The danger and caution notices are listed in numerical order based on their IDs, which are displayed in parentheses, for example (D004), at the end of each notice. Use this ID to locate the translation of these danger and caution notices in the *IBM System Storage b-type Switch and Router Safety Notices* publication, which is shipped with this product.

The following notices and statements are used in IBM documents. They are listed below in order of increasing severity of potential hazards. Follow the links for more detailed descriptions and examples of the danger, caution, and attention notices in the sections that follow.

- **Note:** These notices provide important tips, guidance, or advice.
- **“Attention notices” on page xviii:** These notices indicate potential damage to programs, devices, or data.
- **“Caution notices” on page xvi:** These statements indicate situations that can be potentially hazardous to you.
- **“Danger notices”:** These statements indicate situations that can be potentially lethal or extremely hazardous to you. Safety labels are also attached directly to products to warn of these situations.
- In addition to these notices, “Safety labels” on page xvii may be attached to the product to warn of potential hazards.

Danger notices

A danger notice calls attention to a situation that is potentially lethal or extremely hazardous to people. A lightning bolt symbol accompanies a danger notice to represent a dangerous electrical condition. Read and comply with the following danger notices before installing or servicing this device.



DANGER

To prevent a possible shock from touching two surfaces with different protective ground (earth), use one hand, when possible, to connect or disconnect signal cables. (D001)



DANGER

Overloading a branch circuit is potentially a fire hazard and a shock hazard under certain conditions. To avoid these hazards, ensure that your system electrical requirements do not exceed branch circuit protection requirements. Refer to the information that is provided with your device or the power rating label for electrical specifications. (D002)



DANGER

If the receptacle has a metal shell, do not touch the shell until you have completed the voltage and grounding checks. Improper wiring or grounding could place dangerous voltage on the metal shell. If any of the conditions are not as described, STOP. Ensure the improper voltage or impedance conditions are corrected before proceeding. (D003)



DANGER

An electrical outlet that is not correctly wired could place hazardous voltage on metal parts of the system or the devices that attach to the system. It is the responsibility of the customer to ensure that the outlet is correctly wired and grounded to prevent an electrical shock. (D004)

A general electrical danger notice provides instructions on how to avoid shock hazards when servicing equipment. Unless instructed otherwise, follow the procedures in the following danger notice.



DANGER

When working on or around the system, observe the following precautions:

Electrical voltage and current from power, telephone, and communication cables are hazardous. To avoid a shock hazard:

- Connect power to this unit only with the IBM provided power cord. Do not use the IBM provided power cord for any other product.
- Do not open or service any power supply assembly.
- Do not connect or disconnect any cables or perform installation, maintenance, or reconfiguration of this product during an electrical storm.
- The product might be equipped with multiple power cords. To remove all hazardous voltages, disconnect all power cords.
- Connect all power cords to a properly wired and grounded electrical outlet. Ensure that the outlet supplies proper voltage and phase rotation according to the system rating plate.
- Connect any equipment that will be attached to this product to properly wired outlets.
- When possible, use one hand only to connect or disconnect signal cables.
- Never turn on any equipment when there is evidence of fire, water, or structural damage.
- Disconnect the attached power cords, telecommunications systems, networks, and modems before you open the device covers, unless instructed otherwise in the installation and configuration procedures.
- Connect and disconnect cables as described below when installing, moving, or opening covers on this product or attached devices.

To disconnect:

1. Turn off everything (unless instructed otherwise).
2. Remove the power cords from the outlets.
3. Remove the signal cables from the connectors.
4. Remove all cables from the devices.

To connect:







1. Turn off everything (unless instructed otherwise).
2. Attach all cables to the devices.
3. Attach the signal cables to the connectors.
4. Attach the power cords to the outlets.
5. Turn on the devices.

(D005)

Caution notices

A caution notice calls attention to a situation that is potentially hazardous to people because of some existing condition. A caution notice can be accompanied by different symbols, as in the examples below:

Table 1. Sample caution notices

If the symbol is...	It means...
	A hazardous electrical condition with less severity than electrical danger.
	A generally hazardous condition not represented by other safety symbols.
	A specification of product weight that requires safe lifting practices. The weight range of the product is listed below the graphic, and the graphic and the wording of the caution varies, depending on the weight of the device.
	A potential hazard of pinching the hand or other body parts between parts.
	A hazardous condition due to moving parts nearby.
	A hazardous condition due to the use of a laser in the product. Laser symbols are always accompanied by the classification of the laser as defined by the U. S. Department of Health and Human Services (for example, Class I, Class II, and so forth).

Read and comply with the following caution notices before installing or servicing this device.



CAUTION:

Energy hazard present. Shorting may result in system outage and possible physical injury. Remove all metallic jewelry before servicing. (C001)

CAUTION:

This part or unit is heavy but has a weight smaller than 18 kg (39.7 lb). Use care when lifting, removing, or installing this part or unit. (C008)



CAUTION:

The system contains circuit cards, assemblies, or both that contain lead solder. To avoid the release of lead (Pb) into the environment, do not burn. Discard the circuit card as instructed by local regulations. (C014)



CAUTION:

This product is equipped with a 3-wire (two conductors and ground) power cable and plug. Use this power cable with a properly grounded electrical outlet to avoid electrical shock. (C018)



Class I

CAUTION:

This product might contain one or more of the following devices: CD-ROM drive, DVD-ROM drive, DVD-RAM drive, or laser module, which are Class 1 laser products. Note the following information:

- Do not remove the covers. Removing the covers of the laser product could result in exposure to hazardous laser radiation. There are no serviceable parts inside the device.
- Use of the controls or adjustments or performance of procedures other than those specified herein might result in hazardous radiation exposure.

(C026)



CAUTION:

The power-control button on the device does not turn off the electrical current supplied to the device. The device might also have more than one connection to dc power. To remove all electrical current from the device, ensure that all connections to dc power are disconnected at the dc power input terminals. (C031)

Safety labels

As an added precaution, safety labels are often installed directly on products or product components to warn of potential hazards. These can be either danger or caution notices, depending upon the level of the hazard.

The actual product safety labels may differ from these sample safety labels:



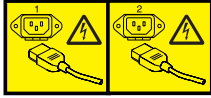
DANGER

Hazardous voltage, current, or energy levels are present inside any component that has this label attached. Do not open any cover or barrier that contains this label. (L001)



DANGER

Rack-mounted devices are not to be used as a shelf or work space. (L002)



DANGER

Multiple power cords. The product might be equipped with multiple power cords. To remove all hazardous voltages, disconnect all power cords. (L003)



DANGER

Hazardous voltage present. Voltages present constitute a shock hazard, which can cause severe injury or death. (L004)

Attention notices

An attention notice indicates the possibility of damage to a program, device, or system, or to data. An exclamation point symbol may accompany an attention notice, but is not required. A sample attention notice follows:

Attention: Do not bend a fibre cable to a radius less than 5 cm (2 in.); you can damage the cable. Tie wraps are not recommended for optical cables because they can be easily overtightened, causing damage to the cable.

Rack safety

Rack installation

DANGER

Observe the following precautions when working on or around your IT rack system:

- Heavy equipment—personal injury or equipment damage might result if mishandled.
- Always lower the leveling pads on the rack cabinet.
- Always install stabilizer brackets on the rack cabinet.
- To avoid hazardous conditions due to uneven mechanical loading, always install the heaviest devices in the bottom of the rack cabinet. Always install servers and optional devices starting from the bottom of the rack cabinet.
- Rack-mounted devices are not to be used as shelves or work spaces. Do not place objects on top of rack-mounted devices.



- Each rack cabinet might have more than one power cord. Be sure to disconnect all power cords in the rack cabinet when directed to disconnect power during servicing.
- Connect all devices installed in a rack cabinet to power devices installed in the same rack cabinet. Do not plug a power cord from a device installed in one rack cabinet into a power device installed in a different rack cabinet.
- An electrical outlet that is not correctly wired could place hazardous voltage on the metal parts of the system or the devices that attach to the system. It is the responsibility of the customer to ensure that the outlet is correctly wired and grounded to prevent an electrical shock.

(R001 part 1 of 2)

CAUTION:

- Do not install a unit in a rack where the internal rack ambient temperatures will exceed the manufacturer's recommended ambient temperature for all your rack-mounted devices.
- Do not install a unit in a rack where the air flow is compromised. Ensure that air flow is not blocked or reduced on any side, front, or back of a unit used for air flow through the unit.
- Consideration should be given to the connection of the equipment to the supply circuit so that overloading of the circuits does not compromise the supply wiring or overcurrent protection. To provide the correct power connection to a rack, refer to the rating labels located on the equipment in the rack to determine the total power requirement of the supply circuit.
- *(For sliding drawers)* Do not pull out or install any drawer or feature if the rack stabilizer brackets are not attached to the rack. Do not pull out more than one drawer at a time. The rack might become unstable if you pull out more than one drawer at a time.
- *(For fixed drawers)* This drawer is a fixed drawer and must not be moved for servicing unless specified by the manufacturer. Attempting to move the drawer partially or completely out of the rack might cause the rack to become unstable or cause the drawer to fall out of the rack.

(R001 part 2 of 2)

Rack relocation (19" rack)

CAUTION:

Removing components from the upper positions in the rack cabinet improves rack stability during relocation. Follow these general guidelines whenever you relocate a populated rack cabinet within a room or building:

- Reduce the weight of the rack cabinet by removing equipment starting at the top of the rack cabinet. When possible, restore the rack cabinet to the configuration of the rack cabinet as you received it. If this configuration is not known, you must do the following:
 - Remove all devices in the 32U position and above.
 - Ensure that the heaviest devices are installed in the bottom of the rack cabinet.
 - Ensure that there are no empty U-levels between devices installed in the rack cabinet below the 32U level.
 - If the rack cabinet you are relocating is part of a suite of rack cabinets, detach the rack cabinet from the suite.
 - Inspect the route that you plan to take when moving the rack to eliminate potential hazards.
 - Verify that the route that you choose can support the weight of the loaded rack cabinet. Refer to the documentation that came with your rack cabinet for the weight of a loaded rack cabinet.
 - Verify that all door openings are at least 760 x 2030 mm (30 x 80 in.).
 - Ensure that all devices, shelves, drawers, doors, and cables are secure.
 - Ensure that the four leveling pads are raised to their highest position.
 - Ensure that there is no stabilizer bracket installed on the rack cabinet during movement.
 - Do not use a ramp inclined at more than 10 degrees.
 - Once the rack cabinet is in the new location, do the following:
 - Lower the four leveling pads.
 - Install stabilizer brackets on the rack cabinet.
 - If you removed any devices from the rack cabinet, repopulate the rack cabinet from the lowest position to the highest position.
 - If a long distance relocation is required, restore the rack cabinet to the configuration of the rack cabinet as you received it. Pack the rack cabinet in the original packaging material, or equivalent. Also, lower the leveling pads to raise the casters off of the pallet and bolt the rack cabinet to the pallet.

(R002)

Product recycling and disposal

Refer to the *IBM Systems Environmental Notices and User Guide* (Z125-5823) for translated environmental statements and information regarding product recycling and disposal. This document may be provided either in printed version or on the product documentation CD.

About this document

This document is intended for use by systems administrators and technicians experienced with networking, Fibre Channel, and storage area network (SAN) technologies. It describes how to install, service, and use the IBM System Storage® SAN32B-E4 (machine type 2498, model E32) Encryption Switch. Throughout this document, the product is referred to as the *encryption switch*, the *SAN32B-E4*, or simply the *switch*.

This document has been created to include information specific to SAN32B-E4 switches running on Fabric OS version 6.4.1 or later. This document does not support all Fabric OS versions. It is specific to Fabric OS v6.4.1 or later.

Product documents

The following documents contain information related to this product. The documentation may be printed material or may be on the documentation CD that is shipped with the product. Newer versions of product documentation may be available through the IBM Publications Center Web site www.ibm.com/shop/publications/order. Search by publication title or publication number. Newer versions may also be available through the IBM Support Portal www.ibm.com/supportportal. Enter your product machine type (2498) or name in the search field, and then select **Documentation** from the displayed page.

- *IBM System Storage SAN32B-E4 Installation, Service, and User Guide*, GA32-0798 (this document)
- *IBM System Storage b-type Switch and Router Safety Notices*
- *IBM Environmental Notices and User Guide*, Z125-5823

Brocade documents

IBM b-type switches use software licensed from Brocade Communications Systems, Inc. You can find information related to the software that supports the director in the following documents on the CD-ROM supplied with this product:

Brocade Fabric OS

- *Fabric OS Administrator's Guide*
- *Fabric OS Command Reference Manual*
- *Fabric OS MIB Reference Manual*
- *Fabric OS Message Reference Manual*
- *Fabric OS Troubleshooting and Diagnostics Guide*
- *Fabric OS Fibre Channel over IP Administrator's Guide*
- *Fabric OS Encryption Administrator's Guide Supporting Tivoli Key Lifecycle Manager (TKLM) Environments*

Brocade Fabric OS optional features

- *Fabric Watch Administrator's Guide*
- *Web Tools Administrator's Guide*

Brocade HBA publication

- *Brocade Adapters Administrator's Guide*

IBM and Brocade product matrix

When you use any of the Brocade documents, you will notice that the model numbers reflect the original Brocade products. Table 2 provides a product matrix for you to use to correlate the Brocade products and models to the IBM product names and machine types and model numbers. Products withdrawn from marketing are not listed.

Table 2. Brocade and IBM product and model number matrix

Brocade product name	IBM product name	IBM machine type and model number
Brocade DCX-4S	SAN384B	2499 Model 192
Brocade DCX	SAN768B	2499 Model 384
Brocade Encryption Switch	SAN32B-E4	2498 Model E32
Brocade 48000	SAN256B Director	2109 Model M48
Brocade 8000	IBM Converged Switch B32	3758 Models B32 and L32
Brocade 7800	SAN06B-R	2498 Model R06
Brocade 7500E	SAN04B-R	2005 Model R04
Brocade 5300	SAN80B-4	2498 Model B80
Brocade 5100	SAN40B-4	2498 Models B40 and 40E
Brocade 300	SAN24B-4	2498 Models B24 and 24E

Chapter 1. Introducing the SAN32B-E4

The SAN32B-E4 Encryption Switch is a high performance 32-port auto-sensing 8 Gbps Fibre Channel switch with cryptography (encryption/decryption) and data compression capabilities. It is designed to encrypt data for enterprises to secure their data against theft or unauthorized use, and to compress tape data for maximum utilization of tape media. The switch is a network-based solution that secures data-at-rest for heterogeneous tape drives, disk array LUNs, and virtual tape libraries using IEEE Advanced Encryption Standard (AES) 256-bit algorithms.

In addition to its 32 Fibre Channel ports, the switch has:

- One RJ45 1000/100/10 Ethernet management port
- Two RJ45 Gigabit Ethernet (GE) ports for clustering interconnection and re-key, and DEK synchronization within cluster
- One RJ45 serial console port
- One USB port for serviceability, error logging, and firmware upgrades

Deployment of encryption with the switch is non-disruptive. Data can be encrypted without reconfiguration of the SAN, and provisioning can be implemented without shutting-down applications. The switch can be configured and managed with the Data Center Fabric Manager (DCFM) and CLI management tools, and can be integrated with existing network infrastructure (FOS and M-EOS).

The encryption switch has these features

- 32 front-end 1, 2, 4, or 8 Gbps auto-sensing F, FL, E, EX, or M ports to connect host servers, SAN disks, SAN tapes, edge switches, or core switches
- Encryption and decryption engines to provide in-line crypto services with up to 96 Gbps throughput for disk I/O and up to 48 Gbps throughput for tape I/O (mix of ciphertext and cleartext traffic)
- Integrated with industry leading key management systems, including Lifetime Key Management (LKM) and RSA Key Manager (RKM)
- Full 1:1 subscription on all 32 ports at 8 Gbps
- HA cluster, Data Encryption Key (DEK) cluster, and Encryption Group (EG) to enable transparent failover, host MPIIO failover, and centralized management of multiple encryption switches
- Support for automatic expiry or CLI manual based re-keying
- Compliance with encryption standards: AES256-XTS 1619.1 (for disk); AES256-GCM IEEE 1619.2 (for tape)
- Smart Card, available as a field-replaceable unit (FRU) from IBM, providing additional encryption security management
- Hardware-based key management and generation
- Integrated Routing Fabric Service (optional) to enable encryption capabilities across multiple fabrics
- NPIV support
- Two hot-swappable, redundant power supply FRUs
- Three hot-swappable fan FRUs in the N+1 configuration to provide hardware-redundant cooling
- One RJ45 1000/100/10 Ethernet management port

- Two RJ45 GE ports for clustering interconnection and re-key, and DEK synchronization within cluster
- One RJ45 serial console port
- A USB port that facilitates firmware upgrades, serviceability, and system-log functionality
- A switch subsystem and encryption subsystem which feature a CPU running at 1.3 GHz with integrated peripherals that provide high performance with low power consumption
- Inter-Switch Link (ISL) Trunking (licensable), allowing up to eight ports (at 1.0625 Gbps, 2.125 Gbps, 4.25 Gbps, or 8.5 Gbps data rate) between a pair of switches to be combined to form a single, logical ISL with a speed of up to 64 Gbps (full duplex) for optimal bandwidth utilization and load balancing
- Dynamic Path Selection (DPS), optimizing fabric-wide performance and load balancing by automatically routing data to the most efficient available path in the fabric
- Small Form-Factor Pluggable (SFP) or SFP+ optical transceivers, providing support for a combination of Short Wavelength (SWL), Long Wavelength (LWL), or Extended Long Wavelength (ELWL) optical media among the switch ports

Note: The full range of 1, 2, 4, and 8 Gbps can only be achieved by a combination of 4 Gbps SFPs (1, 2, and 4 Gbps) and 8 Gbps SFP+ (2, 4, and 8 Gbps).

- Fabric Operating System (Fabric OS) support, delivering distributed intelligence throughout the network and enabling a wide range of applications including Web Tools and zoning. Optional fabric services include: Adaptive Networking with QoS, Extended Fabrics, Enhanced Group Management, Fabric Watch, ISL Trunking, Integrated Routing, and End-to-End Performance Monitoring (APM).
- Extensive diagnostics and system-monitoring capabilities to enhance high Reliability, Availability, and Serviceability (RAS)
- Port and performance scalability through an Encryption Performance Upgrade license. The base configuration provides 34 Gbps of encryption bandwidth. Each Encryption Performance Upgrade license activates an additional 34 Gbps bandwidth. Each switch accepts two encryption-performance upgrades for a total of 102 Gbps of encryption bandwidth. The front-end user ports in the basic, first, and second levels of encryption bandwidth remain as 32 ports at 8 Gbps Fibre Channel.

Port side of the switch

The port side (see Figure 1 on page 3) includes the switch power and status LEDs, clustering and re-keying ports, Smart Card reader, management, console, and USB port, and the Fibre Channel ports and their corresponding status LEDs.

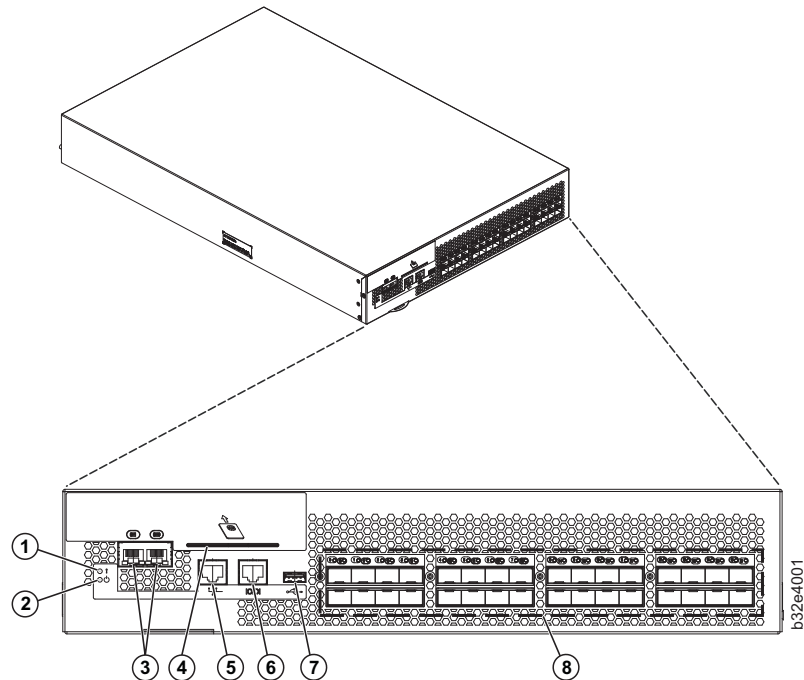


Figure 1. Port side view

- | | |
|---|---------------------------------------|
| 1 System status LED | 5 RJ45 GE management port |
| 2 System power LED | 6 RJ45 serial console port |
| 3 RJ45 GE ports (for clustering and re-keying) | 7 USB port |
| 4 Smart Card reader | 8 Fibre Channel ports (0 - 31) |

The Fibre Channel ports are numbered from left to right on the faceplate; 0-15 on the top row, and 16-31 on the bottom row (see Figure 2).

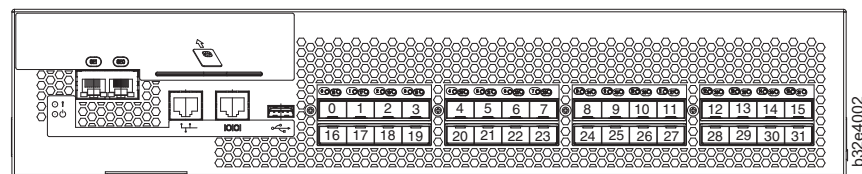


Figure 2. Port numbering

Nonport side of the switch

Figure 3 on page 4 shows the nonport side of the switch, which contain the combined power supplies and fans.

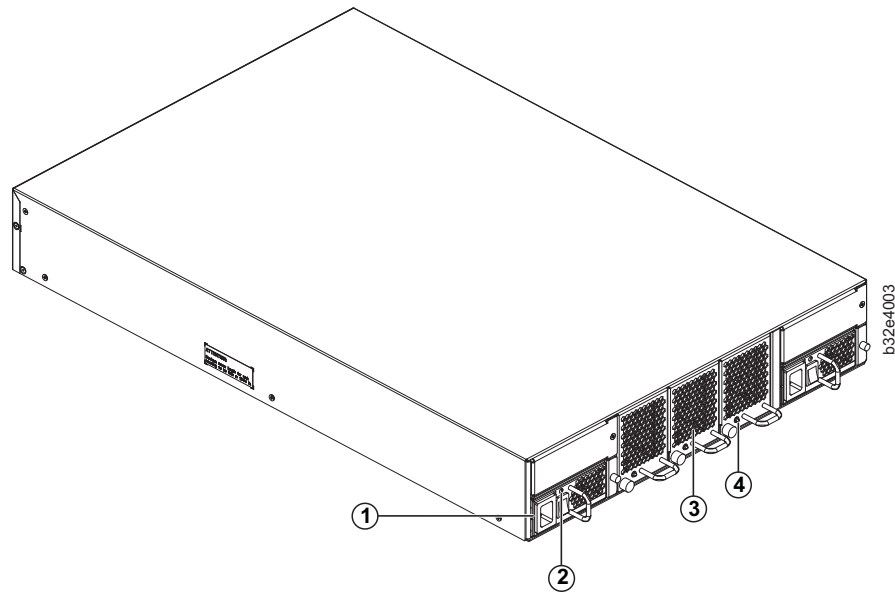


Figure 3. Nonport side of the switch

- | | |
|----------------------------------|-------------------------|
| 1 Power supply (2) | 3 Fan (3) |
| 2 Power supply status LED | 4 Fan status LED |

Field-replaceable units (FRUs)

The switch has two power supply (Figure 4 on page 5) and three fan assembly (Figure 5 on page 5) FRUs that are redundant and hot swappable. The FRUs are capable of functioning universally (100 - 240 VAC input range) without voltage jumpers or switches. The power supply FRUs are identical and interchangeable; the fan assembly FRUs are also identical and interchangeable. The switch chassis itself (Figure 6 on page 6) is also a FRU.

Smart cards, which provide additional encryption security management options, are available through IBM as FRUs. See the *Fabric OS Encryption Administrator's Guide Supporting Tivoli Key Lifecycle Manager (TKLM) Environments* for more information regarding this recommended optional functionality. Part numbers for FRUs are listed in "Parts list (FRUs)" on page 52.

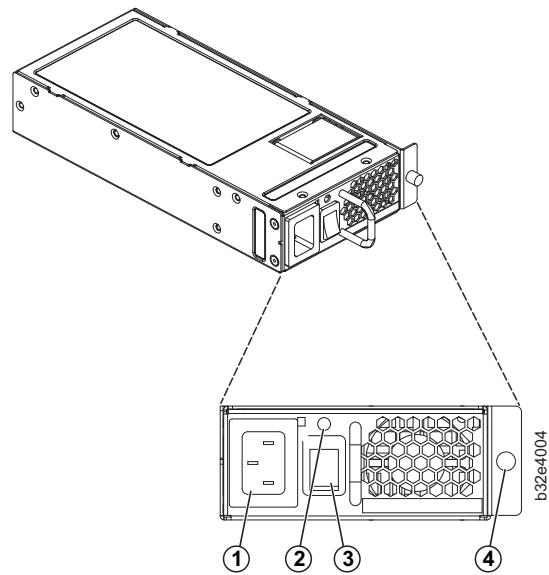


Figure 4. Power supply

- | | |
|----------------------------------|------------------------|
| 1 Power-cord connection | 3 Power switch |
| 2 Power supply status LED | 4 Captive screw |

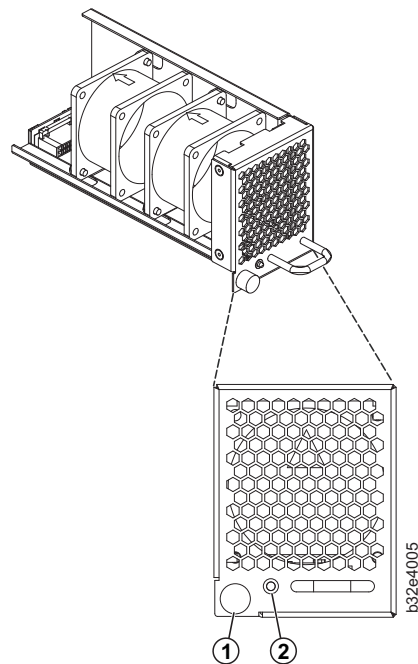


Figure 5. Fan assembly

- | | |
|------------------------|-------------------------|
| 1 Captive screw | 2 Fan status LED |
|------------------------|-------------------------|

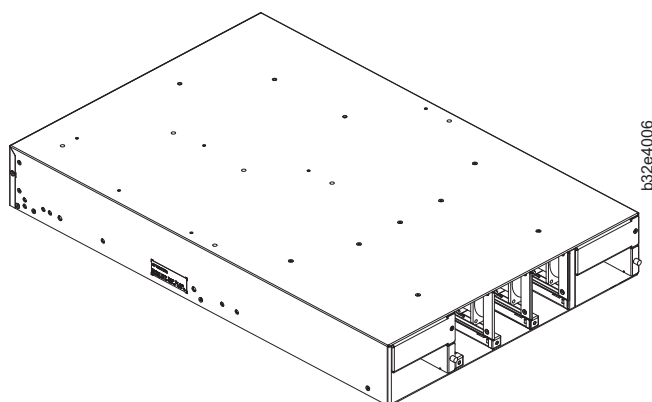


Figure 6. Switch chassis

Planning for encryption

Attention: Setup of this switch for encryption requires the use of this document for the physical installation of the switch. Critical information required for enabling and managing encryption is contained in the *Fabric OS Encryption Administrator's Guide Supporting Tivoli Key Lifecycle Manager (TKLM) Environments*, which is included on the documentation CD-ROM that is shipped with the product. You must use both documents in order to successfully set up the switch for encryption.

Careful attention to details of setup and configuration are essential to enabling a secure encryption functionality. The following guidelines should be followed when planning for encryption with the SAN32B-E4 switch or the 16-port encryption blade (FS8-18), which is available for the SAN768B and SAN384B products.

- Redundancy of hardware is essential because if the encryption path is disrupted, access to the encrypted data will be lost with a single encryption device. You must have two encryption devices to ensure backup and access in the event that one of the devices goes down. If one of the devices in the encryption pair is not functioning, you will only have read access to the encrypted data on the functioning device until the non-functioning device is restored. Redundancy of hardware for encryption can be accomplished with the following:
 - Two Key Vault locations on different devices
 - Two encryption devices in any combination of encryption switches (SAN32B-E4) and FS8-18 encryption blades (in SAN768B or SAN384B chassis)
- Cable planning for the encryption switch and its back-up and for a primary and secondary key vault manager is critical. These devices can be separated by distance as long as they can maintain constant communication contact. One device must back up the other to ensure access to encrypted data. Refer to the *Fabric OS Encryption Administrator's Guide Supporting Tivoli Key Lifecycle Manager (TKLM) Environments* for more information on Master Keys (MK).
- Begin with a limited application of encryption in a test environment and once an expanded encryption test is successful, move the encryption into production
- Avoid dual encryption (Fabric encryption and device encryption). While this should not cause any encryption errors, it will degrade performance.

- There is no support of Cisco switches at this time by IBM. The section in the *Fabric OS Encryption Administrator's Guide Supporting Tivoli Key Lifecycle Manager (TKLM) Environments* related to Cisco Fabric connectivity does not currently apply.
- The use of Smart Cards provides additional encryption security management, and is highly recommended. Smart cards can be ordered as FRUs through IBM.
- The Top Talker feature is not compatible with redirection zones. The Top Talker feature should not be enabled when an encryption switch or blade is present in the fabric.
- Alias zoning is not supported in encryption environments. You must use the real WWPN.
- Refer to the "Steps for connecting to a TKLM appliance" section of the *Fabric OS Encryption Administrator's Guide Supporting Tivoli Key Lifecycle Manager (TKLM) Environments* for detailed information on initial setup. That section includes the following information:
 - All switches you plan to include in an encryption group must have a secure connection to the Tivoli Key Lifecycle Manager (TKLM). A local LINUX host must be available to transfer certificates.
 - Be sure that the clock time on the TKLM server and on the Brocade encryption nodes are the same. A difference of only a few minutes can cause the TLS connectivity to fail.
 - Repeat the same steps for configuring both the primary and the secondary key vault.
 - Both the primary and secondary key vaults should be registered before exporting MK or encrypting LUNs. If the secondary key vault is registered midway after encryption is done for some of the LUNs, then the key database should be backed up and restored on the secondary TKLM from the already registered primary TKLM before registering the secondary TKLM.
 - The following is a suggested order for the initial steps needed to create a secure connection to TKLM. (Refer to the "Steps for connecting to a TKLM appliance" section of the *Fabric OS Encryption Administrator's Guide Supporting Tivoli Key Lifecycle Manager (TKLM) Environments* for additional steps.)
 1. Initialize all encryption nodes to generate Key authentication center (KAC) certificates and export the signed KAC certificates to a local LINUX host.
 2. Obtain the necessary user credentials and log in to the TKLM server appliance from the TKLM management web console.

Chapter 2. Installing and configuring the switch

Attention: Refer to “Planning for encryption” on page 6 for planning recommendations specific to encryption.

You can install the SAN32B-E4 encryption switch in the following ways:

- As a stand-alone unit on a flat surface. For instructions and more information, see “Setting up the switch as a standalone unit” on page 11.
- In an Electronic Industries Association (EIA) cabinet using the fixed rack mount kit, slide rack mount kit, or the mid-mount rack kit. For more information, see “Installing in an EIA cabinet” on page 13.

This chapter provides the following information:

- “Site preparation and installation guidelines” on page 10
- “Items included with the switch” on page 11
- “Setting up the switch as a standalone unit” on page 11
- “Installing in an EIA cabinet” on page 13
- “Configuring the switch” on page 19
- “Configuring for encryption” on page 26
- “Managing license keys (optional)” on page 27

Table 3. Installation tasks, time, and items required

Installation task	Time estimate	Items required
Site preparation and unpacking the switch	30 minutes	None
Installing the rack mount kit	30 minutes	Rack mount kit, 1/4-inch slotted-blade screwdriver, 11/32-inch wrench
Mounting and securing the switch in the rack	15 minutes	
Installing power cables and powering on the switch	10 minutes	Power cables (provided in the accessory kit)
Establishing serial connection, logging on to switch, and configuring IP addresses.	20 minutes	Serial cable (provided in the accessory kit), workstation computer with a serial port or terminal server port and a terminal emulator application (such as HyperTerminal), Ethernet IP addresses for the switch
Installing an Ethernet cable, opening a Telnet session, and configuring the switch domain ID, date and time, and additional system parameters. Verifying and backing up configuration.	20 minutes	Ethernet cable for Telnet access. Refer to the <i>Fabric OS Administrator's Guide</i> for more information.
Installing SFPs, attaching and managing fiber optic cables.	15 minutes	SFP optical transceivers, fiber optic cables, and hook and loop cable wraps



Attention: Read the “Safety notices and labels” on page xiii before attempting any installation, maintenance, or service procedures.

Site preparation and installation guidelines

The following steps are required to ensure correct installation and operation.

1. Provide a space that is 2 rack units (2U) high. 1U is equal to 4.45 cm (1.75 in.).
2. Plan to install the switch with the nonport side facing the air-intake aisle.
Ensure that:

- A minimum of 90.1 cubic meters per hour (53 cubic feet per minute) of airflow is available to the air intake vents on the nonport side of the switch.
- The air intake and exhaust vents have a minimum of 2 inches of airspace.
- The air temperature on the air intake side is less than 40° C (104° F) during operation.

3. Ensure that dedicated electrical branch circuits with the following characteristics are available:
 - The primary outlet is correctly wired, protected by a circuit breaker, and grounded in accordance with local electrical codes.
 - The supply circuit, line fusing, and wire size are adequate, as specified by the electrical rating on the switch nameplate.
 - The power supply standards are met. See “Power specifications” on page 52.

Attention: To maximize fault tolerance, connect each power cord to a separate power source.

4. Plan for cable management before installing the chassis.
Cables can be managed in a variety of ways, such as by routing cables below the chassis, to either side of the chassis, through cable channels on the sides of the cabinet, or by using patch panels.
5. For configuration of the switch:
 - Plan for two IP addresses, and corresponding subnet masks and gateway addresses. One IP address for the virtual IP address on the cluster interconnect; and another IP address for the management port.
 - Ensure that the following are available:
 - Workstation with an installed terminal emulator, such as HyperTerminal
 - Serial cable (provided)
 - Three Ethernet cables
 - Access to an FTP server for backing up the switch configuration or collecting supportsave output data (optional)
 - Brocade USB drive for collecting supportsave output data (optional)
 - SFPs and compatible cables

Planning for cable management

Attention: The minimum bend radius for a 50 micron cable is 2 in. under full tensile load and 1.2 in. with no tensile load.

Cables can be organized and managed in a variety of ways: for example, using cable channels on the sides of the cabinet or patch panels to minimize cable management. Following is a list of recommendations:

- Plan for rack space required for cable management before installing the switch.
- Leave at least 1 meter (3.28 ft) of slack for each port cable. This provides room to remove and replace the switch, allows for inadvertent movement of the rack, and helps prevent the cables from being bent to less than the minimum bend radius.
- If you are using ISL Trunking, consider grouping cables by trunking groups. The cables used in trunking groups must meet specific requirements, as described in the *Fabric OS Administrator's Guide*.
- For easier maintenance, label the fiber optic cables and record the devices to which they are connected.
- Keep LEDs visible by routing port cables and other cables away from the LEDs.
- Use hook and loop style straps to secure and organize fiber optic cables. Do not use tie wraps on fiber optic cables; they can be easily overtightened and can damage the optic fibers.

Items included with the switch

The following items are included with the standard shipment of the switch. When you open the packaging, verify that these items are included in the package and that no damage occurred during shipping.

Note: If any items are damaged or missing, within the United States and Canada, contact the IBM Quality Hotline toll-free 1-800-442-6773 or direct dial in other locations: 770-858-8459.

- The SAN32B-E4 switch, containing two power supplies and three fan assemblies
- Rack mount kit
- An accessory kit that contains the following items:
 - *SAN32B-E4 Installation, Service, and User Guide* (this document).
 - IBM documentation CD
 - Warranty
 - Translated safety notices
 - Four rubber mounting feet, required for setting up the product as a stand-alone unit
 - Two grounded 6 ft. (1.8 m.) country-specific power cables
 - Serial cable with an RJ-45 connector
 - Paperpack of optional features license and key activation information (if ordered)

Attention: Retain this paperpack in a safe place. The transaction keys in the paperpack are required for activation of optional features on the switch. Once a feature is activated, its activation key is associated with a specific product WWN and serial number.

Setting up the switch as a standalone unit

To install the switch as a standalone unit, use the following procedure:

1. Unpack the switch and verify that all items listed in “Items included with the switch” are present and undamaged.
2. Clean the four corner depressions on the bottom of the switch enclosure, place an adhesive rubber foot in each one, and firmly press into place. The rubber feet on the switch help prevent the switch from sliding off the supporting surface.

3. Place the switch on a flat, sturdy surface.
4. Provide power to the switch as described in “Providing power to the switch” on page 20.

Attention: Do not connect the switch to the network until the IP address is correctly set. For instructions on how to cable and configure the switch, and how to set the IP address, see “Configuring the switch” on page 19.

Installing in an EIA cabinet

Attention: Refer to “Rack safety” on page xix for danger and caution notices related to rack and cabinet installations.

You can install the rack mount kit in only one way in a cabinet, with the port side of the switch able to slide out of the exhaust-air side of the cabinet.

Note: Illustrations in this section may not match the specific switch being installed.

Time required

Approximately 45 minutes, not including configuration or cabling.

Items required

You need the following items to install the switch in a slide-rail rack:

- Straight slot screwdriver
- Rack space: 2U of rack space
- Two power cables that are provided with the switch
- Two power outlets
- Rack mount kit

Attention: Use the exact screws specified in the procedure for use with the switch chassis. Using screws longer than 3/16 in. can damage the switch. The different types of screws are listed in Table 4 on page 14. Make sure that you tighten all screws used in this procedure.

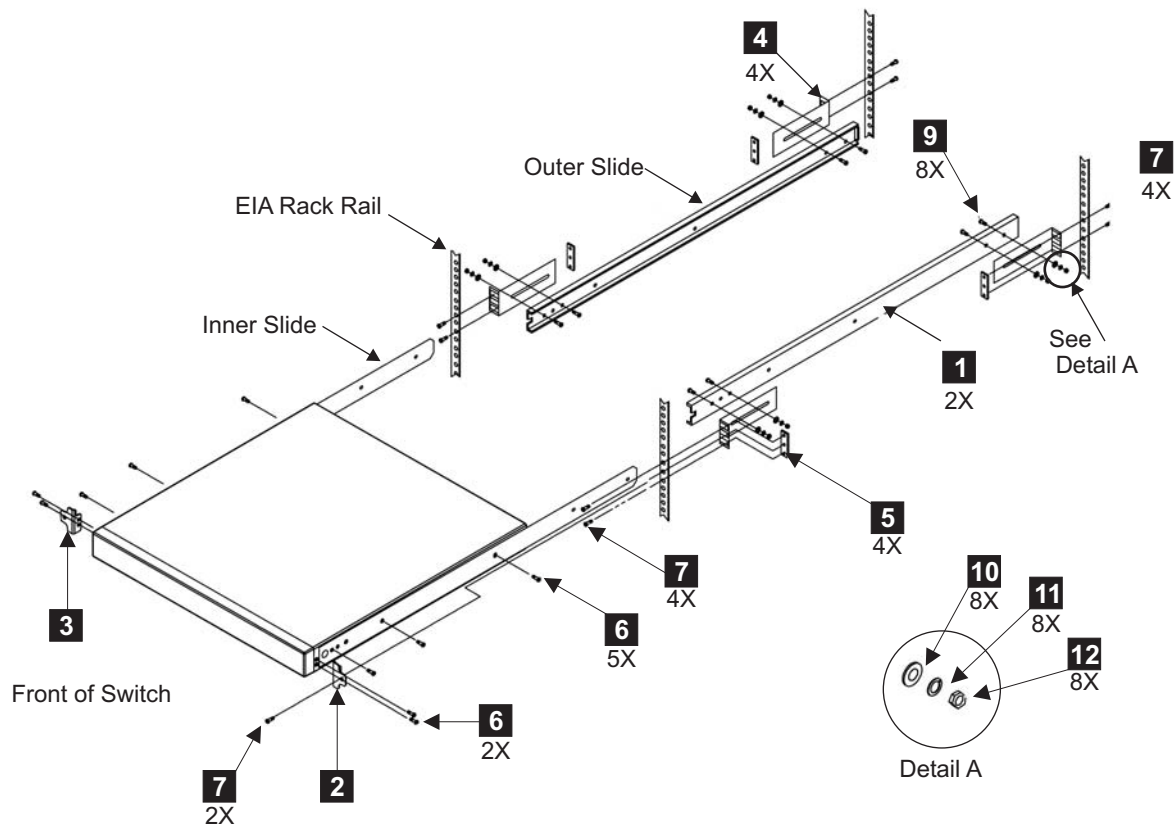
Installation instructions

To install the switch in a slide-rail rack that meets EIA standards, use the following procedure.

Note: These procedures use parts that are included in the rack-mount kit. These parts are listed in Table 4 on page 14. The installation procedure cross-references the items in this table. Be sure to use the referenced parts when you perform each step.

Before you start the rack-mount installation process, locate the rack-mount slides and the mounting bracket that are provided in the shipping container.

Figure 7 on page 14 shows the rack assembly. The number keys, such as **1**, refer to the items listed in Table 4 on page 14.



SJ000153

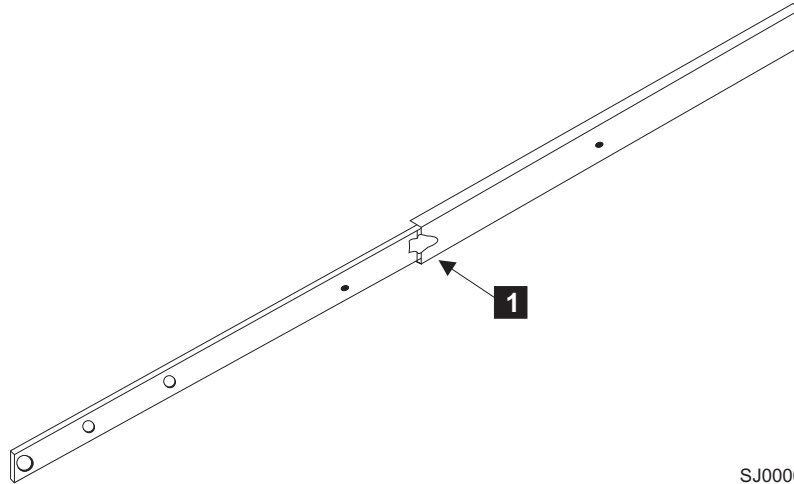
Figure 7. Rack assembly

1. Unpack the rack-mount kit and verify that all ordered items and parts are present and undamaged. See Table 4 for a list of parts and the quantities supplied.

Table 4. Parts supplied with the rack-mount kit

Item	Description	Quantity
1	Rack mount slide (inner and outer slide)	2
2	Right rack mount bracket (optional bracket for front of switch)	1
3	Left rack mount bracket (optional bracket for front of switch)	1
4	Rack mounting bracket (3-hole)	4
5	Nut clip, M5	11
6	Screw, 8-32 x 3/16 in., zinc	11
7	Screw, M5 x 12	11
8	Bracket to slide rack kit (contains items 9 - 12)	1
9	Screw, 8-32 x 3/8 in., zinc	8
10	Washer, flat, No. 8	8
11	Washer, lock, No. 8	8
12	Nut, hex, 8-32	8

2. Separate the inner and outer slides.
 - a. Open one of the slides until the lock engages.
 - b. Press the lock release lever (**1** in Figure 8) and remove the inner rail from the outer rail.



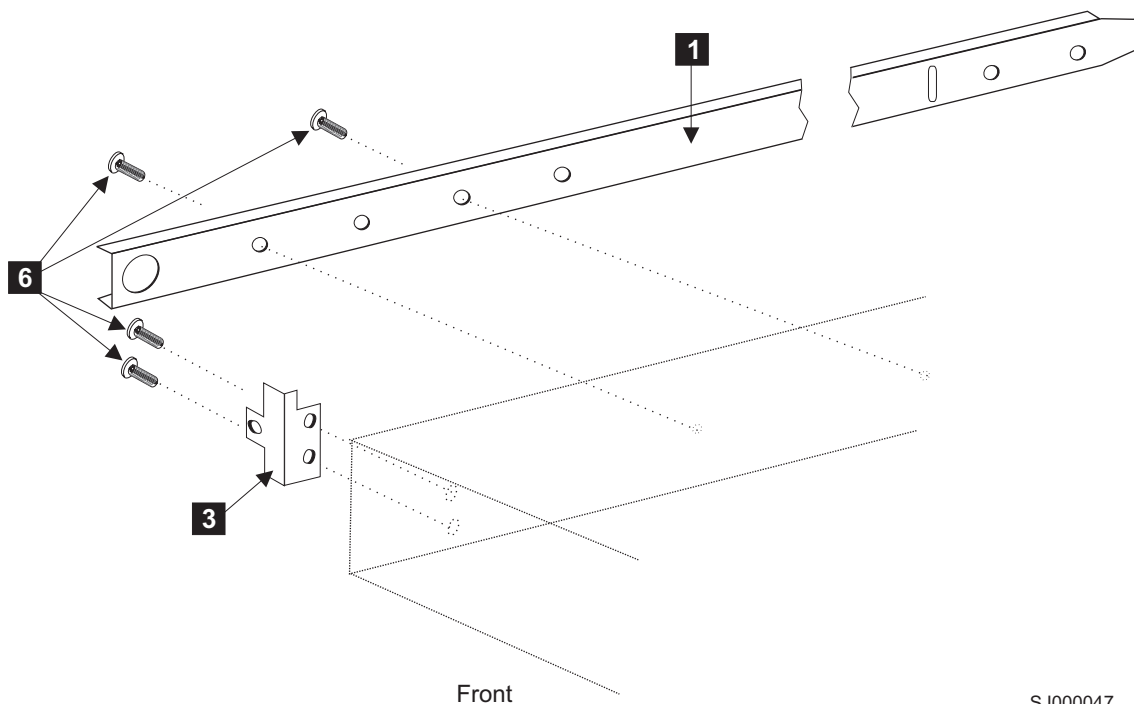
SJ000046

Figure 8. Separating the inner and outer rails.

- c. Repeat step 2a and step 2b for the other rail.
- Note:** For racks with flush-mount doors, such as the 9306 Netfinity® racks, do not install the ears. Instead, use the rack-mount slides by attaching the switch to the set of mounting holes, which are offset 3 inches into the rack.
3. Install the inner (smaller) slide on the switch chassis, as Figure 7 on page 14 shows.

Attention: If you use screws longer than 3/16 in. you can damage the switch.

 - a. Position the flat side of the inner rail along one side of the switch. Align the holes in the rail with the threaded holes in the side of the switch chassis. The chamfered end of the inner rail should face toward the rear of the switch (away from the ports) as shown in Figure 9 on page 16.
 - b. Attach the inner rail by using three of the 8-32 x 3/16 in. zinc screws (**6** in Table 4 on page 14).



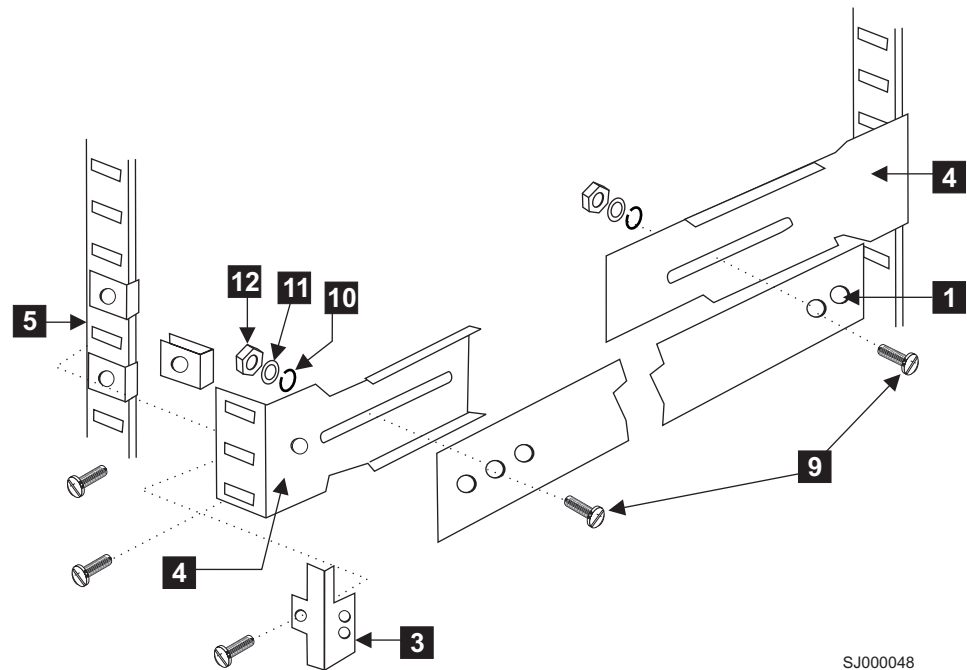
SJ000047

Figure 9. Mounting the moving portion of the slide and mounting brackets to the switch

- c. Repeat step 3a on page 15 and step 3b on page 15 for the second inner rail on the other side of the switch chassis.
4. Optional step: If desired, install the right rack mount bracket **2** (see Figure 7 on page 14) and the left rack mount bracket **3** on the switch chassis. Use these brackets to secure the switch to the rack as shown in Figure 9.

Attention: Do not use screws longer than 3/16 in.; they can damage the switch.

 - a. Position the left rack mount bracket at the left front corner of the switch chassis. Align the two holes in the bracket with the two threaded holes in the switch chassis.
 - b. Attach the bracket by using two of the 8-32 x 3/16 in. zinc screws (see **6** in Figure 7 on page 14)
 - c. Repeat step 4a and step 4b for the right rack mount bracket on the right front corner of the switch chassis.
5. Attach all four of the 3-hole rack mounting brackets **4** in Figure 10 on page 17.
 - a. Position a 3-hole rack mounting bracket **4** at the end of one of the outer slides.
 - b. Attach the bracket by using the 8-32 x 3/8 in. zinc screws **9**. Ensure that the screw heads are inside the slides.
 - c. Place one each of the following items on the outer end of the screw in the order listed (see Detail A in Figure 7 on page 14):
 - 1) Washer, flat No. 8 **10**
 - 2) Washer, lock No. 8 **11**
 - 3) Nut, hex, 8-32 **12**
 - d. Repeat steps 5a through 5c for the three remaining rail ends.



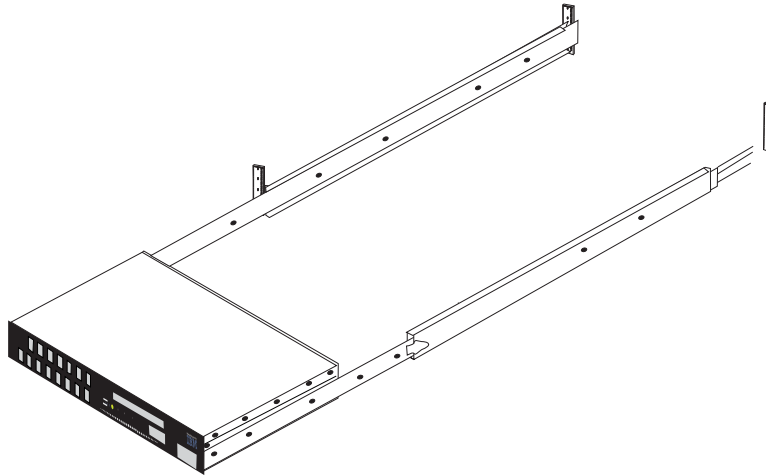
SJ000048

Figure 10. Mounting the fixed portion of the rail and the locking brackets to the rack

6. Install the outer (larger) slides in the rack, as shown in Figure 10.
 - a. At the desired height, install the five M5 nut clips **5**. Put three M5 nut clips in the front of the rack and two in the back. The middle clip in the front of the rack is for the locking ears.

Note: Some rack mount kits might use 10-32 nut clips in place of the M5 nut clips for the locking ears.

 - b. Attach the slides by using four M5 x 12 screws **7** (see Figure 7 on page 14).
 - c. Repeat step 6a and step 6b for the other rail.
7. Install the switch in the rack.
 - a. Position the switch in front of the rack. Insert the switch into the rack by sliding the inner slides that are mounted on the switch into the outer slides that are mounted on the rack. See Figure 11 on page 18.



SJ000049

Figure 11. Inserting slides into the rack rails

- b. Check the alignment of the slides by sliding the switch in and out of the rack. Any difficulty moving the switch indicates lateral stress or misalignment. If this situation occurs, adjust the slide positions until the movement is smooth.
8. Optional step: If the right and left rack mount brackets are installed on the front corners of the switch, attach both brackets to the cabinet rack by using M5 x 12 screws **7**. See step 4 on page 16 and Figure 7 on page 14. The screws should pass through the front of each bracket and the slide rail.

Note: Some rack mount kits might use 10-32 nut clips in place of the M5 nut clips for the locking ears.

9. Continue with initial setup of the switch by following the procedures in “Configuring the switch” on page 19.

Attention: Do not connect the switch to the network until you perform one of the following steps:

- Set the internet protocol (IP) address.
- Verify that the default IP address does not conflict with the existing IP addresses in the same network.

Configuring the switch

You must configure the switch before it can operate within a network and fabric. This section provides the basic steps required for the initial setup of the switch. For instructions on configuring the switch to operate in a network containing switches from other vendors, refer to the *Fabric OS Administrator's Guide*. For specific information related to encryption and key management, refer to the *Fabric OS Encryption Administrator's Guide Supporting Tivoli Key Lifecycle Manager (TKLM) Environments*.

For more information about the commands used in these procedures, refer to the *Fabric OS Command Reference*.

To configure the switch, perform the following tasks. Figure 12 on page 20 illustrates the flow of these configuration tasks.

- “Providing power to the switch” on page 20
- “Connecting a serial cable between the switch and a host” on page 21
- “Logging in to the serial console port” on page 21
- “Setting the switch IP address” on page 21
- “Connecting an Ethernet cable and opening a Telnet session” on page 22
- “Setting the switch domain ID” on page 22
- “Setting the switch date and time” on page 22
- “Installing SFPs and attaching cables” on page 24
- “Managing cables” on page 25
- “Verifying the correct operation of the switch and backing up the configuration” on page 25

Attention: Do not connect the switch to the network until the IP address is correctly set.

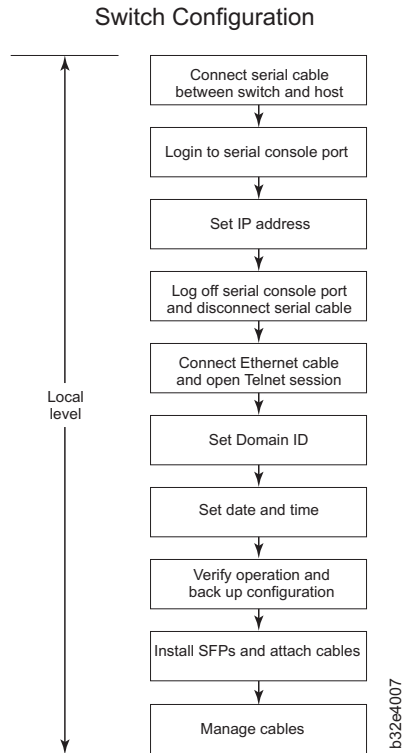


Figure 12. Switch configuration steps

Providing power to the switch



DANGER

An electrical outlet that is not correctly wired could place hazardous voltage on metal parts of the system or the devices that attach to the system. It is the responsibility of the customer to ensure that the outlet is correctly wired and grounded to prevent an electrical shock. (D004)

Follow these steps to power on the switch

1. Connect the power cords to both power supplies
2. Connect the other end of the power cords to power sources. Ensure that the cords have a minimum service loop of 6 in. available and are routed to avoid stress.

Note: Power is supplied to the switch as soon as the first power supply is connected and turned on. To protect against AC failure, connect the power cords to outlets on separate circuits.

3. Press the "I" area of both power switches.
4. After POST is complete, verify that the switch power LED on the port side is green and the switch status LED on the port side is off.

Attention: Do not connect the switch to the network until the IP address is set.

Connecting a serial cable between the switch and a host

All basic configuration tasks in this guide are performed using a serial connection. Follow these steps to connect a serial cable.

1. Remove the plug from the serial port and connect the serial cable provided with the switch.
2. Connect the serial cable to the console port on the switch and to an RS-232 serial port on the workstation.
If the serial port on the workstation is RJ-45 instead of RS-232, remove the adapter from the end of the serial cable and insert the exposed RJ-45 connector into the RJ-45 serial port on the workstation.
3. Disable any serial communication programs running on the workstation.
4. Open a terminal emulator application (such as HyperTerminal on a PC, or TERM, TIP, or Kermit in a UNIX environment), and configure the application as follows:

- In a Windows environment:

Bits per second	9600
Databits	8
Parity	None
Stop bits	1
Flow control	None

- In a UNIX environment, enter the following string at the prompt:

```
tip /dev/ttyb -9600
```

If ttyb is already in use, then use ttya instead and enter the following string at the prompt:

```
tip /dev/ttya -9600
```

Logging in to the serial console port

To log in to the switch through the serial connection, follow these steps.

1. Verify that the switch has completed POST. When POST is complete, the port status and switch power and status LEDs return to a standard healthy state; for information about LED patterns, see “Interpreting LEDs” on page 31.
2. When the terminal emulator application stops reporting information, press **Enter** to display the login prompt.
3. Log in to the switch as **admin**, using the default password, *password*. You will be prompted to change the default passwords at initial login.

Setting the switch IP address

Configure the switch with a static IP address.

1. Log into the switch using the default password, which is *password*.
2. Use the **ipaddrset** command to set the Ethernet IP address.
 - Enter the IP address in dotted decimal notation as prompted.
3. Complete the rest of the network information as prompted.

```
Ethernet Subnetmask: 255.255.255.0
Ethernet IP Address: 192.168.74.102
Ethernet Subnetmask: 255.255.255.0
```

4. Optionally, verify that the address was correctly set by entering the **ipAddrShow** command at the prompt.
5. Record the IP address on the pull out tab provided for this purpose on the port side of the switch.
6. If the serial port is no longer required, use the logout command to log out of the serial console, remove the serial cable, and replace the plug in the serial port.

Connecting an Ethernet cable and opening a Telnet session

To create an Ethernet connection to the switch, follow these steps.

1. Remove the plug from the Ethernet port.
2. Connect an Ethernet cable to the switch Ethernet port and to the workstation or to an Ethernet network containing the workstation.
3. Open a Telnet session on the workstation.

Note: The following information describes using the CLI but these tasks can be performed using Web Tools or Data Center Fabric Manager .

Setting the switch domain ID

To set the switch domain ID, follow these steps.

1. Log on to the switch through Telnet, using the admin account.
2. Modify the domain ID if required.

The default domain ID is 1.

- If the switch is not powered on until after it is connected to the fabric and the default domain ID is already in use, the domain ID for the new switch is automatically reset to a unique value.
 - If the switch is connected to the fabric after it has been powered on and the default domain ID is already in use, the fabric will segment. To find the domain IDs that are currently in use, run the **fabricShow** command on another switch in the fabric.
- a. Disable the switch by entering the **switchDisable** command.
 - b. Enter the **configure** command. The command prompts will display sequentially; enter a new value or press **Enter** to accept each default value.
 - c. Enter **y** after the "Fabric param" prompt:
Fabric param (yes, y, no, n): [no] **y**
 - d. Enter a unique domain ID (such as the domain ID used by the previous switch, if still available):
Domain: (1..239) [1] **3**
 - e. Complete the remaining prompts or press **Ctrl+D** to accept the remaining settings without completing all the prompts.
 - f. Re-enable the switch by entering the **switchEnable** command.

Setting the switch date and time

The date and time settings are used for logging events. Switch operation does not depend on the date and time; a switch with an incorrect date and time value still functions properly. However, because the date and time are used for logging, error detection, and troubleshooting, you should set them correctly.

Perform the following steps to set the date and time of the switch.

Setting the date

1. If necessary, log on to the switch by Telnet, using the **admin** account.
2. Enter the **date** command, using the following syntax:

```
date "mmddHHMMyy"
```

The values represent the following:

- mm is the month; valid values are 01 through 12
- dd is the date; valid values are 01 through 31
- HH is the hour; valid values are 00 through 23
- MM is minutes; valid values are 00 through 59
- yy is the year; valid values are 00 through 99 (values greater than 69 are interpreted as 1970 through 1999, and values less than 70 are interpreted as 2000-2069)

```
switch:admin> date  
Fri Sep 26 12:29:46 UTC 2008  
switch:admin> date "0926123008"  
Fri Sep 26 12:30:00 UTC 2008  
switch:admin>
```

Setting the time zone of the switch

To set the time zone, follow these steps.

1. If necessary, log on to the switch by Telnet, using the admin account.
2. Enter the **tsTimeZone** command as follows:

```
switch:admin> tsTimeZone [--interactive]/ [, timezone_fmt]
```

Use `timezone_fmt` to set the time zone by Country/City or by time zone ID, such as MST.

The following example shows how to change the time zone to US/Mountain.

```
switch:admin> tsTimeZone  
Time Zone : US/Pacific  
switch:admin> tsTimeZone US/Mountain  
switch:admin> tsTimeZone  
Time Zone : US/Mountain
```

The following procedure describes how to set the current time zone using interactive mode.

1. Enter the **tsTimeZone** command as follows:

```
switch:admin> tsTimeZone --interactive
```

You are prompted to select a general location.

Please identify a location so that time zone rules can be set correctly.

2. Enter the appropriate number or **Ctrl+D** to quit.
3. At the prompt, select a country location.
4. At the prompt, enter the appropriate number to specify the time zone region or **Ctrl+D** to quit.

For more detailed information about the parameters of the **tsTimeZone** command, refer to the *Fabric OS Command Reference*.

Synchronizing local time with an external source

To synchronize the local time of the principal or primary switch with that of an external NTP server, follow these steps.

1. If necessary, log on to the switch by Telnet, using the admin account.
2. Enter the **tsClockServer** command.

```
switch:admin> tsclockserver "<ntp1;ntp2>"
```

where ntp1 is the IP address or DNS name of the first NTP server, which the switch must be able to access. The second ntp2 is the second NTP server and is optional. The operand "<ntp1;ntp2>" is optional; by default, this value is LOCL, which uses the local clock of the principal or primary switch as the clock server.

The **tsClockServer** command accepts multiple server addresses in either IPv4, IPv6, or DNS name formats. When multiple NTP server addresses are passed, **tsclockserver** sets the first obtainable address as the active NTP server. The others will be stored as backup servers that can take over if the active NTP server fails. The principal or primary FCS switch synchronizes its time with the NTP server every 64 seconds.

```
switch:admin> tsclockserver  
LOCL  
switch:admin> tsclockserver "132.163.135.131"  
switch:admin> tsclockserver  
132.163.135.131  
switch:admin>
```

The following example shows how to set up more than one NTP server using a DNS name:

```
switch:admin> tsclockserver "10.32.170.1;10.32.170.2;ntp.localdomain.net"  
Updating Clock Server configuration...done.  
Updated with the NTP servers  
Changes to the clock server value on the principal or primary FCS switch are  
propagated to all switches in the fabric
```

Installing SFPs and attaching cables

To install SFPs and cables to the switch, follow these steps.

1. If necessary, remove the plugs from the ports to be used.
2. Ensure that the bail (wire handle) is in the unlocked position. Place the SFP in the correct position on the port (Figure 13).

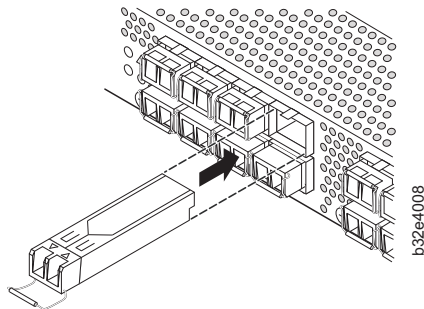


Figure 13. Installing an SFP into an upper port

3. Slide the SFP into the port until it clicks into place. Close the bail.

Note: Each SFP has a 10-pad gold-plated PCB-edge connector on the bottom. Insert SFPs into the upper row of ports with this gold edge down. Insert SFPs into the lower row of ports with the gold edge up.

4. Connect the cables to the transceivers. The cables used in trunking groups must meet specific requirements. For a list of these requirements, see the *Fabric OS Administrator's Guide*.

Note: The cable connectors are keyed to ensure correct orientation. If a cable does not install easily, ensure that it is correctly oriented.

- a. Orient a cable connector so that the key (the ridge on one side of the connector) aligns with the slot in the transceiver. Then, insert the cable into the transceiver until the latching mechanism clicks. For instructions specific to cable type, see the cable manufacturer's documentation.
 - b. Repeat step a for the remaining cables.
5. Check the LEDs to verify that all components are functional. For information about LED patterns, see "Interpreting LEDs" on page 31.
 6. Verify the correct operation of the switch by entering the **switchShow** command from the workstation.

Managing cables

Attention: The minimum bend radius for a 50 micron cable is 2 in. under full tensile load and 1.2 in. with no tensile load.

Cables can be organized and managed in a variety of ways, including using cable channels on the sides of the cabinet or patch panels to minimize cable management. Following is a list of recommendations:

- Plan for rack space required for cable management before installing the switch.
- Leave at least 1 m (3.28 ft) of slack for each port cable. This provides room to remove and replace the switch, allows for inadvertent movement of the rack, and helps prevent the cables from being bent to less than the minimum bend radius.
- If you are using ISL Trunking, consider grouping cables by trunking groups. The cables used in trunking groups must meet specific requirements, as described in the *Fabric OS Administrator's Guide*.
- For easier maintenance, label the fiber optic cables and record the devices to which they are connected.
- Keep LEDs visible by routing port cables and other cables away from the LEDs.
- Use hook-and-loop straps to secure and organize fibre optic cables. Do not use tie wraps on fiber optic cables, because wraps are easily overtightened and can damage the optical fibers.

Verifying the correct operation of the switch and backing up the configuration

To verify the correct operation of the switch and to back up the switch configuration, complete these steps:

1. Check the LEDs to verify that all components are functional. For information about LED patterns, refer to "Interpreting LEDs" on page 31.
2. If necessary, log on to the switch by Telnet, using the **admin** account.
3. Run the **portCfgPersistntEnable** command to activate the FC ports for FC operation.

4. Verify the correct operation of the switch by entering the **switchShow** command from the workstation. This command provides information about the switch and its port status.
5. Verify the correct operation of the switch in the fabric by entering the **fabricShow** command from the workstation. This command provides general information about the fabric.
6. Back up the switch configuration to an FTP server by entering the **configUpload** command and following the prompts. This command uploads the switch configuration to the server, making it available for downloading to a replacement switch if necessary.

It is recommended that the configuration be backed up on a regular basis to ensure that a complete configuration is available for downloading to a replacement switch. For specific instructions about how to back up the configuration, see the *Fabric OS Administrator's Guide*. The **switchShow**, **fabricShow**, and **configUpload** commands are described in detail in the *Fabric OS Command Reference*.

Configuring for encryption

Note: Refer to the *Fabric OS Encryption Administrator's Guide Supporting Tivoli Key Lifecycle Manager (TKLM) Environments* for the procedures to configure the encryption functions.

Summary of procedure

If the switch is being configured for the first time for encryption services, you will need to perform several pre-initialization tasks related to configuring the encryption node (switch), including:

- Generating the Critical Security Parameters (CSPs) and certificates
- Loading and setting up the certificates
- Establishing a trusted link (LKM Appliance)
- Configuring the global parameters and policies of the encryption group
- Generating and backing up the master key in RSA environments
- Handling key-vault high-availability
- Configuring cluster interconnect

After completing the pre-initialization tasks, you may need to perform several tasks related to configuring the encryption group. Figure 14 on page 27 summarizes the flow of the encryption-configuration tasks.

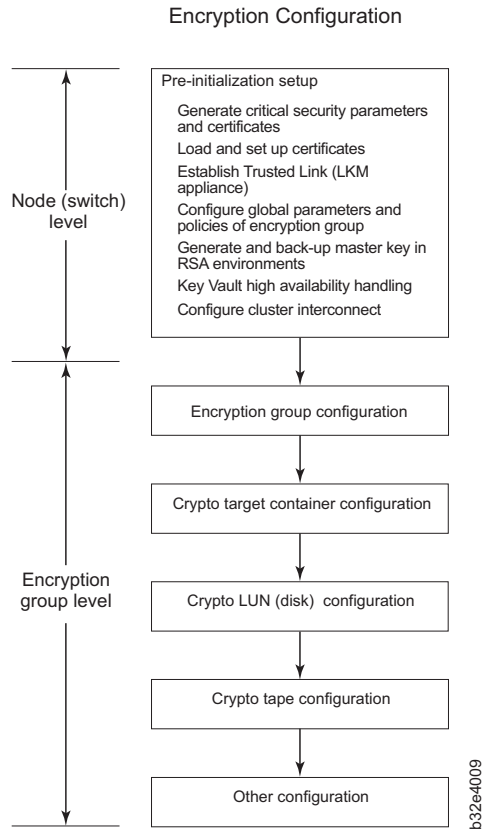


Figure 14. Encryption configuration

If you have purchased the recommended optional Smart card FRU for additional encryption security management, see the "Smart card usage" section of the *Fabric OS Encryption Administrator's Guide Supporting Tivoli Key Lifecycle Manager (TKLM) Environments* for information on using that functionality.

Avoid double encryption

Encryption and decryption at the storage device level does not affect the encryption switch or blade capabilities, and does not cause problems with decrypting the data. However, double encryption adds the unnecessary need to manage two sets of encryption keys, increases the risk of losing data, may reduce performance, and does not add security.

Managing license keys (optional)

Depending on what has been ordered, certain licenses are factory-installed on the switch. Feature licenses might be included as a paperpack item in the switch shipping carton. This paperpack provides you with keys to unlock the features. You can also purchase licenses separately from IBM.

Attention: Retain this paperpack in a safe place. The transaction keys in the paperpack are required for activation of optional features on the switch. After a feature is activated, its activation key is associated with a specific product WWN and serial number.

Refer to the following sections for information about viewing the current licenses, adding a license, or removing a license. For more information on the following procedures, see the *Fabric OS Administrator's Guide* and the *Fabric OS Command Reference*.

Viewing current license keys

To view the licenses that are currently enabled on the switch, complete the following steps.

1. Log in as admin.
2. Enter the **licenseShow** command. A list of the enabled licenses and their features is displayed, as in the following example.

```
APswitch:admin> licenseshow
License Key: bQebzeRdScRfc0iK
              Web license
License Key: SybbzQQ9edTzcd0X
              Zoning license
APswitch:admin>
```

Adding a license key

Licenses for additional functionality may be purchased as feature codes through IBM. Contact your IBM representative for more information. You will need to supply IBM with the WWN to obtain a transaction key, which is sent in a paperpack. To obtain the license key, follow the instructions included in the paperpack. The transaction key and the switch WWN or product serial number are required to obtain the license key.

To add a license to the switch, complete the following steps.

1. Log in as admin.
2. Enter the **switchShow** command to obtain the WWN of your switch. The license key is a string of approximately 16 uppercase and lowercase letters and digits. Case is significant. The key is an encrypted form of the system WWN and the products licensed to run on this system.
3. Enter the **licenseAdd** command, followed by the license key enclosed in quotation marks, as shown in the following example.

```
APswitch:admin> licenseadd "aBcDeFGh12345K"
License key aBcDeFGh12345 added
```

Enter the license key into the system exactly as issued. If you enter it incorrectly, the license might be accepted, but it will not function.

4. After entering the license key, use the **licenseShow** command to verify that it is valid. If a licensed product is not displayed, the license is invalid.

Note: After you enter a license, the licensed product is available immediately; the system does not need to be rebooted.

Removing a license key

To remove a license from the switch, complete the following steps.

1. Log in as admin.
2. Enter the **licenseRemove** command, followed by the license key enclosed in quotation marks, as in the following example.

```
APswitch:admin> licenseremove "bQebzbRdScRfc0iK"
removing license key "bQebzbRdScRfc0iK"
```

3. Save the license key information in case you want to reinstall it in the future.

4. After removing the license key, the switch must be rebooted.
5. Use the **licenseShow** command to verify that the license key has been removed.

Fabric OS firmware updates

To ensure optimum functioning of your system, IBM recommends operating your system with the latest Fabric OS version and firmware updates. Refer to the latest Fabric OS Release Notes and Interoperability Matrix for information regarding Fabric OS compatibility. This is particularly important for fabrics with 1-Gbps switches using earlier Fabric OS versions. Detailed information on downloading and installing firmware are provided in the *Fabric OS Administrator's Guide*.

To access the appropriate matrix:

- Go to the IBM SAN web page www.ibm.com/systems/storage/san
- Select the appropriate product link
- On the displayed product page, click the **Interoperability Matrix** link in the **Learn more** section.

Firmware release notes and download files are available through the IBM Support Portal.

To view release notes and to download firmware:

- Go to the IBM Support Portal www.ibm.com/supportportal.
- Search for the product Machine type, 2498 or the product name.
- On the page that is displayed, select **Download** under the **Task** section.
- From the displayed page, select the **Release notes** link. Review the release notes of the appropriate release version before installing the firmware update.
- Click the **Release Firmware** link and follow the online prompts to navigate to the **Brocade Downloads for IBM End Users** page.
- Follow the links and instructions on the Brocade pages. Note that associated FOS documentation can also be downloaded from this site.

Chapter 3. Using and maintaining the switch

This chapter provides information about operating and maintaining the switch and includes these topics.

- “Interpreting LEDs”
- “Interpreting POST results” on page 34
- “Diagnostic testing” on page 35
- “Checking the FRUs” on page 36

Interpreting LEDs

System activity and status can be determined through the activity of the LEDs on the switch. There are three possible LED states: no light, a steady light, and a flashing light. The lights are green or a combination of green and amber.

Note: The LEDs may flash during boot, POST, or other diagnostic tests. This is normal and does not indicate a problem.

LEDs on the port side of the switch

The port side of the switch has the following LEDs (see Figure 15).

- One system status LED (above) on the left side
- One system power LED (below) on the left side
- One Ethernet link LED at the Ethernet management port
- One Ethernet activity LED at the Ethernet management port
- One link LED at each GE port
- One activity LED at each GE port
- One port status LED for each Fibre Channel port

Figure 15 shows the LEDs on port side of the switch.

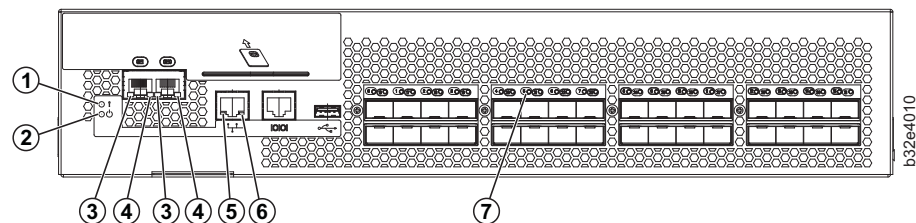


Figure 15. Port side LEDs

- | | |
|---|--|
| 1 System status LED (amber) | 5 Ethernet link LED (green) |
| 2 System power LED (green) | 6 Ethernet activity LED (green) |
| 3 GE (cluster Ethernet) link LED (green) | 7 Port status LED (green/amber, shown for port 5) |
| 4 GE (cluster Ethernet) activity LED (green) | |

System status LED patterns

The system status LED (**1** in Figure 15 on page 31) indicates the overall system status. Table 5 describes the meaning of different displays of the system status LED and recommended action, if any.

Table 5. System status LED patterns

LED color	Status of hardware	Recommended action
No light	System is on and functioning properly.	No action required.
Steady amber (for more than five seconds)	Indicates one of the following: <ul style="list-style-type: none">Fan FRU or power supply FRU is faultyBoot failedSystem is faulty Note: This LED displays steady amber during POST, this is normal and does not indicate a fault.	Try the following: <ul style="list-style-type: none">Verify that the fan FRU and power supply FRU are seated correctlyReplace the fan FRU or power supply FRUReboot the system and monitor the system console output through an attached serial cable. Contact your IBM representative for guidance on the failure indicated.

Power status LED patterns

The power status LED on the front of the switch (see **2** in Figure 15 on page 31) indicates the status of the power supplied to the switch. Table 6 describes the meaning of different displays of the power supply LED and recommended action, if any.

Table 6. Power status LED patterns

LED color	Status of hardware	Recommended action
No light (off)	System is off or there is an internal power supply failure.	Verify that system is powered on (power supply switches to "I"), the power cables are attached, and your power source is live. If the system power LED is not green, the unit may be faulty. Contact your IBM representative.
Steady green	System is on and power supplies are functioning properly	No action required.

Ethernet LED patterns

The Ethernet management port has two LEDs to indicate Ethernet link (**3** and **5** Figure 15 on page 31) and Ethernet status/activity (**4** and **6**). Table 7 describes the meaning of different displays of the Ethernet LEDs and recommended action, if any.

Table 7. Ethernet LED patterns

LED name	LED color	Status of hardware	Recommended action
Ethernet link	No light	There is no link	Verify that the Ethernet cable is connected correctly.
	Steady green	There is a link	No action required.
Ethernet status/activity	No light	No link activity	No action required.
	Flashing green	There is link activity (traffic).	No action required.

Port status LED patterns

The switch has one LED below each Fibre Channel port (**7** in Figure 15 on page 31) to indicate how that particular port is functioning. Table 8 describes the meaning of different displays of the port LEDs and recommended action, if any.

Table 8. Port status LED patterns

LED color	Status of hardware	Recommended action
No light	Indicates one of the following: <ul style="list-style-type: none"> No signal or light carrier (transceiver or cable) detected The switch may be initializing Connected device is configured in an offline status 	Try the following : <ul style="list-style-type: none"> Verify that power LED is on Check the transceiver and cable Verify the switch has completed booting and POST Verify the status of the connected device
Steady green	Port is online (connected to external device) but has no traffic.	No action required.
Slow-flashing green (on 1 second; then off 1 second)	Port is online but segmented because of a loopback cable or incompatible switch connection.	Verify that the correct device is attached to the switch.
Fast-flashing green (on 1/4 second; then off 1/4 second)	Port is online and an internal loopback diagnostic test is running.	No action required.
Flickering green	Port is online and data is flowing through the port.	No action required.
Steady amber	Port is receiving light or signal carrier, but it is not online yet.	No action required.
Slow-flashing amber (on 2 seconds; then off 2 seconds)	Port is disabled because of diagnostics or the portDisable command.	Verify the diagnostic tests are not running. Re-enable the port using the portEnable command.
Fast-flashing amber (on 1/2 second; then off 1/2 second)	SFP or port is faulty.	Reset the port. Replace the SFP. If the problem does not resolve, contact IBM.

LEDs on the nonport side of the switch

The LEDs on the nonport side of the switch provide status information for the two power supplies and three fan assemblies. Figure 16 shows the location of these LEDs on the nonport side of the switch.

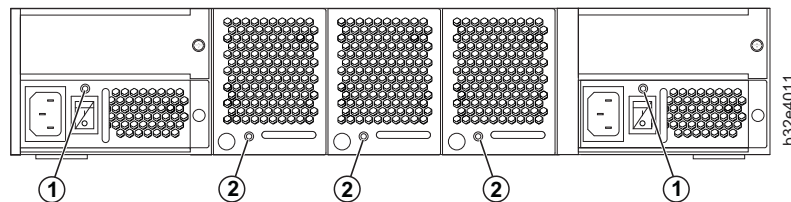


Figure 16. Nonport side LEDs

- 1** Power supply status LED (green/amber) **2** Fan status LED (green/amber)

Power supply and fan status LED patterns

Each power supply has one LED (**1** in Figure 16 on page 33) next to the AC power switch. This LED indicates the status of the power supply. Table 9 describes the meaning of different displays of the LEDs and recommended action, if any.

Table 9. Power supply status LED patterns

LED color	Status of hardware	Recommended action
No light	Indicates one of the following: <ul style="list-style-type: none">• Power supply FRU is switched off• Power supply FRU is not seated correctly• Power cord is disconnected• Power cord is not actively powered• The power supply FRU has failed	Try the following: <ul style="list-style-type: none">• Verify that the power supply FRU is powered on• Verify that the power supply FRU is seated correctly• Check the power cable connections• Replace the power supply FRU
Steady green	Power supply is operating normally.	No action required.
Steady amber (for more than 5 seconds)	Indicates one of the following: <ul style="list-style-type: none">• Power supply FRU is switched off• Power supply FRU is not seated correctly• The power cable is disconnected• The power supply FRU has failed Note: When the switch is first powered on the power supply status LED will show amber until POST has completed.	Try the following: <ul style="list-style-type: none">• Verify that the power supply FRU is powered on• Verify that the power supply FRU is seated correctly• Check the power cable connection• Replace the power supply FRU

Each fan assembly has one LED (**2** in Figure 16 on page 33) next to the fan assembly handle. Table 10 describes the meaning of different displays of the LEDs and recommended action, if any.

Table 10. Fan status LED patterns

LED color	Status of hardware	Recommended action
No light	Indicates one of the following: <ul style="list-style-type: none">• Fan FRU is not seated correctly• Fan FRU is not receiving power	Try the following: <ul style="list-style-type: none">• Verify that the fan FRU is seated correctly• Verify that the switch is powered on.
Steady green	Fan assembly is operating normally.	No action required.
Steady amber (for more than 5 seconds)	Indicates one of the following: <ul style="list-style-type: none">• Fan FRU is not seated correctly• One or more of the fans in the fan FRU has failed• The fan FRU was disabled by the user. Note: When the switch is first powered on the fan status LED will show amber until POST has completed.	Try the following: <ul style="list-style-type: none">• Verify that the fan FRU is seated correctly• Verify that the fan FRU is enabled (use the fanEnable command)• Replace the fan FRU

Interpreting POST results

POST is a system check that is performed each time the switch is powered on, rebooted, or reset, and during which the LEDs may flash amber or green, or remain steady. Total boot time with POST may take up to 3 minutes.

Note: While not recommended, POST can be omitted after subsequent reboots by using the **fastBoot** command or entering the **diagDisablePost** command to persistently disable POST.

For more information about these commands, refer to the *Fabric OS Command Reference*.

To determine whether POST completed successfully and whether any errors were detected:

1. Verify that the LEDs on the switch indicate that all components are healthy (see “Interpreting LEDs” on page 31). If one or more LEDs do not display a healthy state:
 - a. Verify that the LEDs are not set to “beacon”(this can be determined through the **switchShow** command or Web Tools). For information about how to turn beaconing on and off, see the *Fabric OS Administrator’s Guide* or the *Web Tools Administrator’s Guide*.
 - b. Follow the recommended action for the observed LED behavior, as listed in the tables in “Interpreting LEDs” on page 31.
2. Verify that the switch prompt displays on the terminal of a computer workstation that is connected to the switch. If the prompt does not display when POST completes, press **Enter**. If the prompt still does not display, open another Telnet session or access the switch through another management tool. If this is not successful, the switch did not successfully complete POST. Contact your IBM representative.
3. Using either Web Tools or the CLI, verify that the diagnostic status for all ports in the switch is OK.
 - If using Web Tools, select **Port Admin** or **Status** to display information about the ports.
 - If using the CLI, use the **diagShow** command
4. Review the system log for errors.
 - If using Web Tools, errors are listed under **Switch Events**
 - If using the CLI, errors detected during POST are written to the system log, which is viewed using the **errShow** command. For more information about this command, see the *Fabric OS Command Reference*. For information about specific error messages, see the *Fabric OS Message Reference*

Diagnostic testing

In addition to POST, the Fabric OS includes diagnostic tests to troubleshoot the hardware and firmware. This includes tests of internal connections and circuitry, fixed media, and the transceivers and cables. The tests are implemented by command, either through a Telnet session or through a terminal set up for a serial connection to the switch. Some tests require the ports to be connected by external cables, to allow diagnostics to verify the serializer/deserializer interface, transceiver, and cable. Some tests require loopback plugs.

Diagnostic tests are run at link speeds of 1 Gbps, 2 Gbps, 4 Gbps, and 8 Gbps. For information about diagnostic tests, refer to the *Fabric OS Administrator’s Guide*.

Checking the FRUs

The power supplies and the fan assemblies are field-replaceable units (FRUs) and can be replaced on site without the use of special tools. The power supplies and fan assemblies are keyed to ensure correct orientation during installation. To determine the status of these FRUs, use the following diagnostic procedures. Follow the replacement procedures in “Replacing a power supply” and “Replacing a fan assembly” on page 39 if you determine that any FRU is defective.

Verifying power supplies

The two power supplies are hot-swappable if replaced one at a time. They are identical and fit into either slot. Fabric OS identifies the power supplies as follows (viewing the switch from the non-port side):

Attention: Maintain both power supplies in operational condition for redundancy.

- Power supply #1 (**3** in Figure 17 on page 37) on the right
- Power supply #2 (**4**) on the left

To determine if a power supply requires replacing, do either of the following:

- Check the power supply status LED above the On/Off switch (**5** in Figure 18 on page 38). If the power supply status LED is not on, verify that the power supply is on and seated and the power cord is connected to a functioning power source. If the light does not turn green, the power supply may need to be replaced.
- In Web Tools, click the **Power Status** icon.
- Enter the **psShow** command at the command prompt to display power supply status as shown in the example below:

```
switch:admin> psshow
Power Supply #1 is OK
Power Supply #2 is OK
switch:admin>
```
- You can also use the **switchStatusShow** command to verify the status of the power supplies and fan assemblies.

Refer to the *Fabric OS Command Reference* for more information about these commands, and the *Fabric OS Message Reference* for information about specific error messages.

Replacing a power supply

Attention: Before installing, removing, or replacing any component, read and follow the “Safety notices and labels” on page xiii.

Note: Disassembling any part of the power supply voids the part warranty and regulatory certifications. There are no user-serviceable parts inside the power supply.

Attention: The cooling system relies on pressurized air, do not leave either of the power supply slots empty longer than two minutes when the switch is operating. If a power supply fails, leave the power supply in the switch until it can be replaced.

This section describes how to remove and replace the power supply. Although these FRUs can be removed and replaced without special tools, qualified personnel

should perform the installation and service procedures. The switch can continue operating during the FRU replacement if you follow the steps in the procedure.

The switch has two power supplies (**3** and **4** in Figure 17).

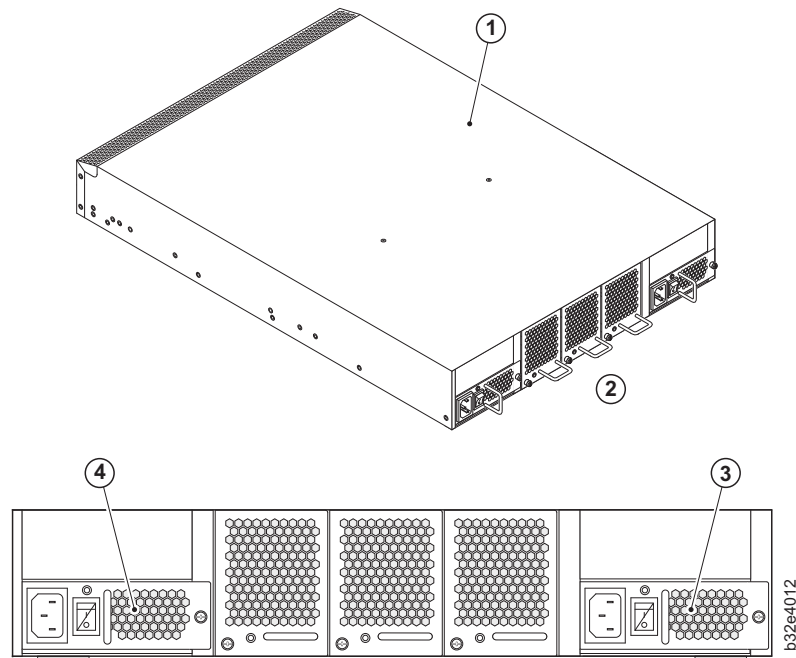


Figure 17. Power supply locations

1 Switch chassis

3 Power supply #1

2 Non-port side

4 Power supply #2

Time required

Less than 2 minutes

Items required

- New power supply
- Phillips #1 screwdriver



DANGER

Hazardous voltage, current, or energy levels are present inside any component that has this label attached. (L001)

Do not service, there are no serviceable parts.

Procedure

Note: To leave the switch in service during replacement of a power supply, verify that the other power supply (the one not being replaced) has been powered on for at least four seconds and has a steady green LED.

Complete the following steps to remove and replace a power supply.

1. Power off the power supply being replaced by pressing the AC power switch (**7** in Figure 18) to "O".
 2. Unplug the power cord from the power supply that you are replacing.
 3. Use a Phillips-head screwdriver to unscrew the captive screw (**3**).
 4. Remove the power supply from the chassis by pulling the handle (**4**) on the power supply out, away from the chassis.
 5. Verify that the AC switch on the new power supply is in the "O" (off) position.
- Attention:** Do not force the installation. If the power supply/fan does not slide in easily, ensure that it is correctly oriented before continuing.
6. Orient the power supply as shown in Figure 18, with the AC switch on the left.

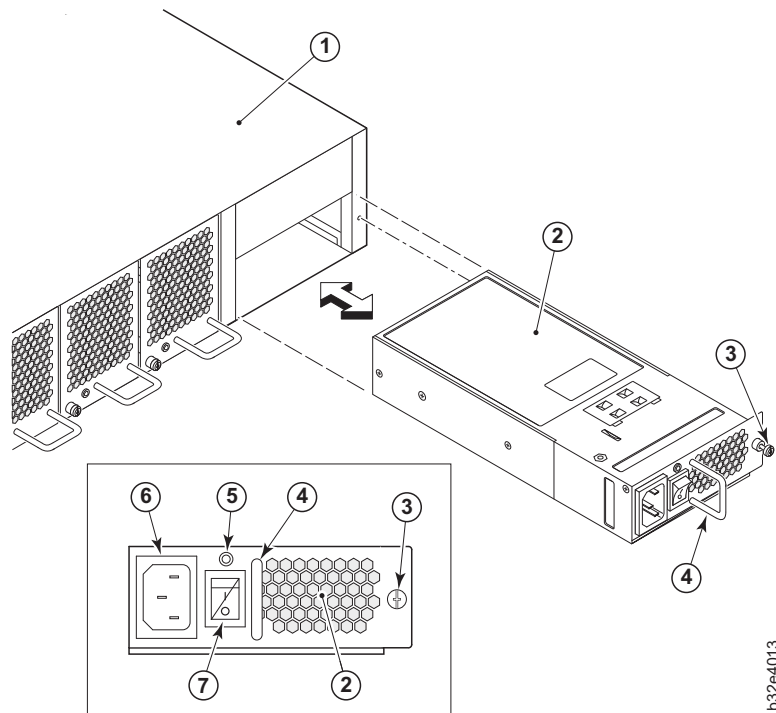


Figure 18. Installing a new power supply

- | | |
|-------------------------|-----------------------------------|
| 1 switch chassis | 5 status LED |
| 2 power supply | 6 AC power cord receptacle |
| 3 captive screw | 7 AC power switch |
| 4 handle | |

7. Using the handle, gently push the power supply into the chassis until it is firmly seated.
8. Secure the power supply to the chassis by tightening the captive screw with the Phillips-head screwdriver.
9. Connect the power cord to the power supply and power on the supply by pressing the AC power switch to "I".
10. Verify that the LED (**5**) on the new power supply displays a steady green light while the switch is operating. If the LED is not green, ensure that the

power supply is securely installed and seated properly, that both ends of the power cord are secure, and that primary power is available.

11. Optionally, enter **psShow** at the command line prompt to view the power supply status. For more information about this command, refer to the *Fabric OS Command Reference*. Power supply status can also be viewed using the Web Tools application.

Verifying fan assemblies

The three fan assemblies are hot-swappable if replaced one at a time. They are identical and fit into any fan slot.

Attention: Maintain all three fan assemblies in operational condition for redundancy.

Fabric OS identifies the power supply/fan assemblies as follows (viewing the switch from the nonport side):

- Fan assembly #1 is on the right
- Fan assembly #2 is in the center
- Fan assembly #3 is on the left

To determine if a fan assembly requires replacing, do any of the following:

- Check the fan assembly status LED (**2** in Figure 16 on page 33). If the fan status LED is not on, verify that the fan is seated correctly. If the light does not turn green, the fan assembly may need to be replaced.
- In Web Tools, check the **Fan Status** icon background color. It will be either yellow or red if the fan has failed. When the fan is functioning correctly, the background color is green.
- Enter the **fanShow** command at the command prompt to display the fan status as shown in the example below:

```
switch:admin> fanshow
Fan 1 is OK, speed is 9507 RPM
Fan 2 is OK, speed is 9246 RPM
Fan 3 is OK, speed is 9337 RPM
```

Replacing a fan assembly

Attention: Before installing, removing, or replacing any component, read and follow the “Safety notices and labels” on page xiii.

Note: Disassembling any part of the fan assembly voids the part warranty and regulatory certifications. There are no user-serviceable parts inside the fan assembly.

Attention: The cooling system relies on pressurized air, do not leave either of the power supply slots empty longer than two minutes when the switch is operating. If a fan assembly fails, leave it in the switch until it can be replaced.

This section describes how to remove and replace a fan assembly. Although these FRUs can be removed and replaced without special tools, qualified personnel should perform the installation and service procedures. The switch can continue operating during the FRU replacement if you follow the steps in the procedure.

The switch has three fan assemblies (**3** , **4** , and **5** in Figure 19 on page 40).

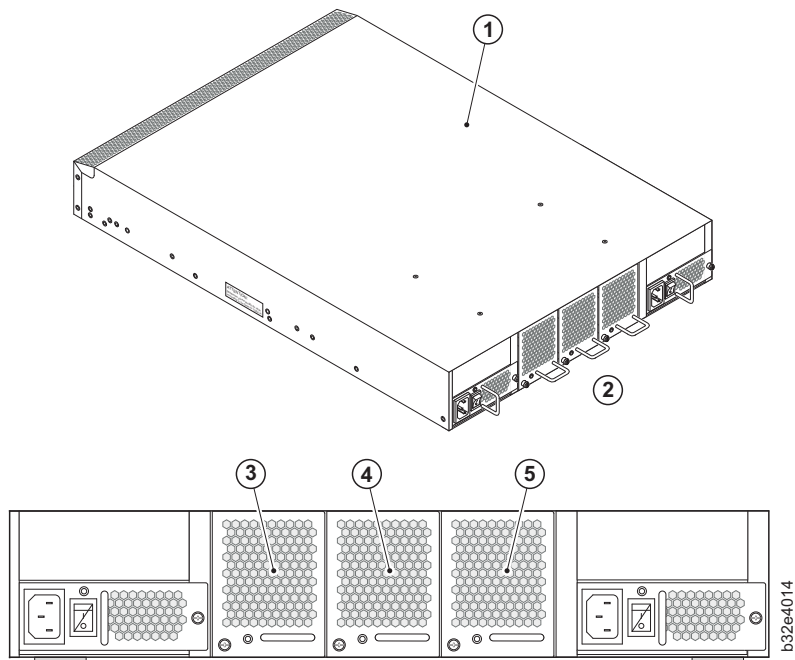


Figure 19. Fan assembly locations

- | | |
|-------------------------|-------------------------|
| 1 Switch chassis | 4 Fan assembly 2 |
| 2 Non-port side | 5 Fan assembly 1 |
| 3 Fan assembly 3 | |

Time required

Less than 2 minutes

Items required

- New fan assembly
- Phillips-head #1 screwdriver

Procedure

Complete the following steps to remove and replace a fan assembly.

1. Using a Phillips-head screwdriver, unscrew the captive screw (**3** in Figure 20 on page 41) on the fan assembly.

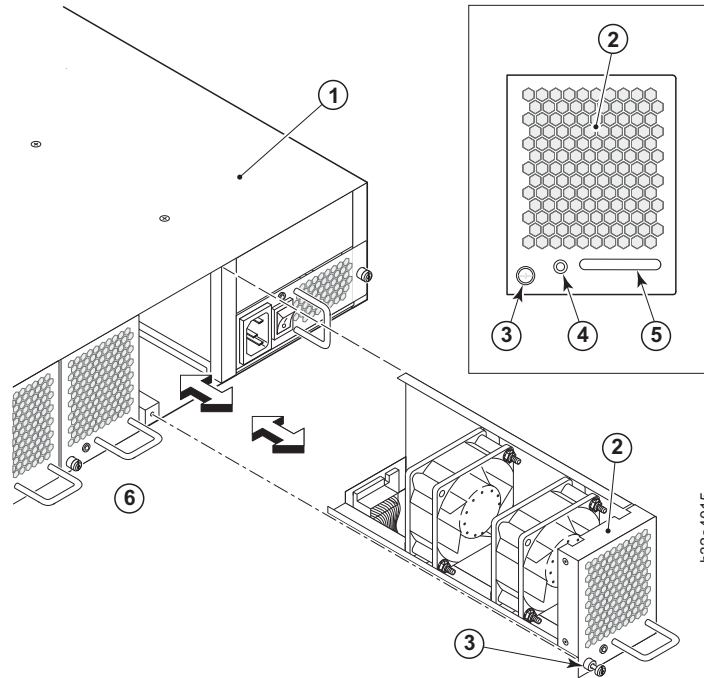


Figure 20. Replacing a fan assembly

- | | |
|-------------------------|-------------------------|
| 1 Switch chassis | 4 Fan status LED |
| 2 Fan assembly | 5 Handle |
| 3 Captive screw | 6 Non-port side |

- Remove the fan assembly from the chassis by pulling the handle (**5**) out, away from the chassis.
- Orient the new fan assembly with the captive screw on the right
- Gently push the fan assembly into the chassis until it is firmly seated.
Attention: Do not force the installation. If the fan assembly does not slide in easily, ensure that it is correctly oriented before continuing.
- Using a Phillips-head screwdriver, secure the fan assembly to the chassis by tightening the captive screw.
- Verify that the fan status LED (**4**) is lit (steady green) to indicate normal operation. If the LED is not green, ensure that the fan assembly is fully seated and securely installed
- Optionally, enter **fanShow** at the command line prompt to view the fan assembly status. For more information about this command, refer to the *Fabric OS Command Reference*. The fan status can also be viewed using the Web Tools application.

Replacing the switch chassis

Attention: The switch must be removed from the fabric and powered off to perform this procedure. Contact IBM support if you have any questions about whether the chassis requires replacement.

If any of the internal circuitry fails within the switch, the entire unit must be replaced. Contact IBM technical support for assistance with ordering the

replacement. Within the United States call 1-800-IBMSERV (1-800-426-7378). For support outside the United States, you can find the service number at: <http://www.ibm.com/planetwide/>.

Once you have received the replacement switch, follow the steps below and any instructions included within the CRU package.

Attention: Before installing, removing, or replacing any component, read and follow the “Safety notices and labels” on page xiii.

Time required

Approximately two hours

Items required

- Replacement switch
- Electrostatic discharge (ESD) grounding strap
- Serial cable and workstation computer with a terminal emulator application (such as HyperTerminal for Windows systems or TIP for Solaris systems), required only if serial console session used
- #2 Phillips screwdriver



DANGER

Hazardous voltage, current, or energy levels are present inside any component that has this label attached. (L001)

Do not service, there are no serviceable parts.

Verifying need for replacement

Verify that replacement of the chassis is necessary. Ensure that the components are firmly seated when troubleshooting, and contact IBM support with any questions about whether the chassis should be replaced. Any of the following events might indicate the need to replace the chassis:

- Visible mechanical damage to the chassis, including damage to sheet metal or guides that prevents correct installation of components.
- Bent or damaged connectors inside the chassis.
- One or more components, such as a power supply or fan assembly, do not function properly even after the component was replaced.
- The **psShow** or **fanShow** commands continue to show a faulty component even though the component was replaced.

Recording critical switch and SAN information

All commands must be entered from a CLI session (Telnet or serial) to the switch unless otherwise indicated.

For detailed information about Fabric OS commands, refer to the *Fabric OS Command Reference*. Use Table 11 on page 43 to ensure that all required information is recorded.

Note: Run the **supportShow** command, which will provide all of the information in Table 11 on page 43 and more.

Table 11. Critical information checklist

Configuration information	
	Location of "config-switch.txt" file
	Location of "config-miscinfo.txt" file
	IP address, subnet mask
	WWN for switch chassis
SAN profile	
	Location of "SANbefor.txt" file
	Notes regarding nsshow output
	Notes regarding nsallshow output
	Notes regarding switchshow output
	Notes regarding fabricshow output
Output from supportshow command	
	Location of "spptshow.txt" file
	Notes regarding supportshow output
Information about the new chassis	
	New factory serial number
	New serial number (if available)

1. Open a Telnet session and log in to the switch as *admin*. The default password is *"password"*. Enable the logging function on your Telnet or serial console connection.
2. Back up the current configuration.
 - Enter **configUpload**; then, enter the requested information at the prompts. This command uploads the switch configuration to the customer-defined FTP server, making it available for downloading. For more information about this command, refer to the *Fabric OS Command Reference*.
 - Alternatively, you can save the configuration file to a Brocade USB drive.
3. Using a workstation, record the switch values (4 through 8 on page 44).
4. Record the IP address information.
Enter **ipAddrShow -sw**; then, copy the command output into the "config-miscinfo.txt" file.
5. Display and record the manufacturer serial numbers.
Enter **chassisShow**; then, copy the command output into the "config-miscinfo.txt" file.
6. Create a SAN profile by entering and recording the information provided by the following commands:
 - **nsShow**
 - **nsAllShow**
 - **switchShow**
 - **fabricShow**

Copy the command output into a text file named "SANbefor.txt". After the switch is restored to the fabric, this information can be used to verify that no unintentional changes have occurred to the fabric.
7. Enter **supportShow**; then, copy the command output into a text file named "spptshow.txt".

Note: The **supportShow** command has a very long output and time for completion. It may last 20 minutes or longer depending on the size of the SAN.

This file provides a backup of all the information that might be required by technical support. The information can be used after the switch is restored to the fabric, to verify that no unintentional changes have occurred to the fabric.

8. Record the cable connections between the switch, and the target devices and ports.

Disconnecting from network and fabric

1. Shut down the switch using the **sysShutdown** command.
2. Power off the chassis by pressing both AC power switches to "O". The power supply status LED should turn off.
3. Remove the power cords from the power supplies and the power outlets.

DANGER

Multiple power cords. The product is equipped with multiple power cords. To remove all hazardous voltages, disconnect all power cords. (L003)

4. Label all cables connected to the switch and record the connections.
5. Disconnect the cables and SFPs from the switch and set them aside.

Removing components from the chassis

1. Remove the power supplies (see "Replacing a power supply" on page 36).
2. Remove the fan assemblies (see "Replacing a fan assembly" on page 39).
3. Remove the switch from the rack. Verify and remove any mounting hardware or screws that prevent the switch from being removed from the cabinet. If the switch is installed on sliding rails, press the release mechanism on the rails to allow full removal of the switch and inner rails.
4. Remove the rail hardware from the switch. Set it aside for attachment to the new switch, making notes as necessary for the correct placement of parts. (Refer to "Installing in an EIA cabinet" on page 13 for illustrations and complete rack mount instructions.)
5. Set the switch aside for later return to IBM, following the instructions included with the replacement switch.

Installing the replacement chassis

1. Unpack the new chassis, saving the packaging for returning the old chassis.
2. Install the rail hardware on the new chassis. Refer to any notes you made during the removal steps and "Installing in an EIA cabinet" on page 13 for illustrations and complete rack mount instructions.

Installing components into the new chassis

1. Replace the fan assemblies (see "Replacing a fan assembly" on page 39).
Attention: Do not force the installation. If the fan assembly does not slide in easily, ensure that it is correctly oriented before continuing.
2. Replace the power supplies (see "Replacing a power supply" on page 36).
Attention: Do not force the installation. If the power supply does not slide in easily, ensure that the power supply is correctly oriented before continuing.
3. Connect the power cords to the power supplies and the power outlets.

4. Power-on the switch (see "Providing power to the switch" on page 20).

Note: Power is supplied to the switch as soon as the first power supply is connected and turned on.

5. Verify that all components are functioning correctly by checking their LEDs. If the LEDs do not indicate correct operation, try reinstalling the corresponding component.

Verifying the correct operation of the system

1. Log in to the switch as *admin*.
2. Verify that the switch is functioning correctly by entering the **switchShow** or **switchStatusShow** commands. The **switchShow** command displays switch and port status information.
3. Verify that all the IP address information is correct by entering **ipAddrShow** and checking the results against the IP information recorded in the "config-miscinfo.txt" file.

Reconnecting the system to the network and fabric

1. Install the SFPs and reconnect the cables to the switch.
2. Organize the cables as required.
Attention: Do not route cables in front of the air exhaust vent (located on the upper portion of the port side of the chassis).

Verifying the correct configuration of the fabric

Copying the command outputs from this section into a file is recommended.

1. Create an "after" SAN profile by entering the following commands and copying the output to a text file named "SANafter.txt":
 - **nsShow**
 - **nsAllShow**
 - **switchShow**
 - **fabricShow**
2. Determine any differences between the information in the "SANafter.txt" file and the information in the "SANbefore.txt" file created earlier. In particular, look for differences in the following:
 - Device types
 - Number of devices
 - ISL and port states
 - Number of switches in the fabric
3. Resolve any issues or unintentional changes to the switch or fabric.
 - If there are any mechanical problems, try reseating the associated component.
 - If the configuration information is not correct for the switch, modify as required. If necessary, the configuration saved before the replacement can be downloaded using the **configDownload** command. The **configDownload** command can be entered through a Telnet or serial session, but the switch must have an Ethernet connection to the server name or IP of the host for the download process to complete. For more information, refer to the **help configdownload** command or the *Fabric OS Command Reference*.
 - If other issues exist, contact IBM support.

Changing the switch serial number

Attention: This procedure is to be used only if a switch has failed and it is being replaced by a new switch.

In the event of a hardware failure, the replacement switch should be configured to display the serial number of the original failed switch, in order to maintain continuity in the IBM service system. Once you have installed the replacement switch, follow the steps below to change the serial number displayed through the switch or fabric management program.

Note: This serial number change procedure requires the user to login as "root".

1. Login as "root" on the switch.
2. Enter the root password "xxxxxxx". Press **Enter**.
3. Enter the **fruinfo set chassis 1** command. Press **Enter**.
4. ID: (none). Press **Enter**.
5. PN: (none). Press **Enter**.
6. SN: (none) > type "**switch Serial Number**". Press **Enter**.
7. RV: (none). Press **Enter**.
8. Chassis SN: (FAxxXxxxxxx). Press **Enter**.

To verify that the serial number has been entered correctly, follow these steps:

9. Enter the **fruinfo set chassis 1** command. Press **Enter**.
10. ID: (none). Press **Enter**.
11. PN: (none). Press **Enter**.
12. SN: (none) > Verify that the "switch Serial Number" displayed is the one you entered. Press **Enter**.
13. RV: (none). Press **Enter**.
14. Chassis SN: (FA0xxXxxxxxx). Press **Enter**.

If the serial number displayed is not correct, repeat the above steps, beginning with step 3.

Powering off the switch

To power off the switch:

1. Using the CLI, enter the **sysShutDown** command.

Note: This command shuts down the key processors and powers off the switch. All LEDs go dark.

2. Set each AC power switch to "O".
3. If necessary, disconnect both power cords from the switch and the facility power to remove power from the system.

Removing the battery

CAUTION:

The battery contains lithium. To avoid possible explosion, do not burn or charge the battery. Do not:

- Throw or immerse into water
- Heat to more than 100°C (212°F)
- Repair or disassemble

Exchange only with the IBM-approved part. Recycle or discard the battery as instructed by local regulations. In the United States, IBM has a process for the collection of this battery. For information, call 1-800-426-4333. Have the IBM part number for the battery unit available when you call. (C003)

Local regulations may require removing the battery prior to disposing of or recycling this product. Complete these steps to remove the battery.

1. Disconnect all power and communication cables.
2. Remove all transceivers.
3. Unscrew captive screws and remove the power supplies and fan assemblies.
4. Unscrew the fasteners and remove the sheetmetal cover.
5. On the circuit board, go to the BC1 location (**1** in Figure 21) and remove the BR1225 battery from the holder.

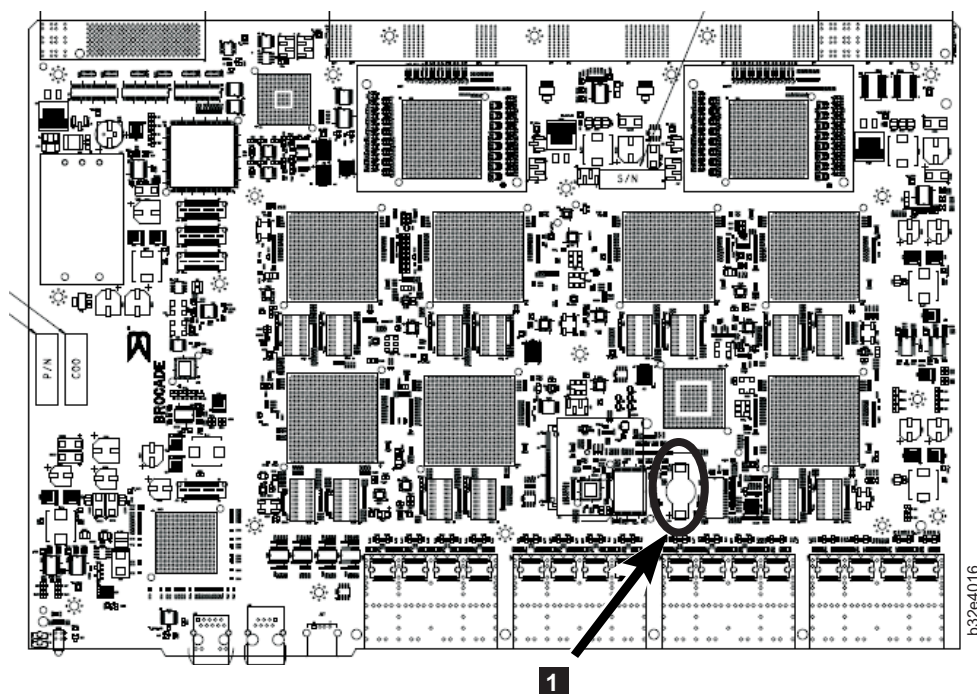


Figure 21. Location of battery holder

6. Recycle the battery as appropriate.

Refer to the *Environmental Notices and User Guide* shipped with the product for more information on battery recycling and disposal.

Appendix. Product specifications

This appendix provides the specifications for the SAN32B-E4 Encryption Switch.

- “General specifications”
- “Management” on page 50
- “Size and weight” on page 51
- “Environmental requirements” on page 51
- “Power specifications” on page 52
- “Data transmission ranges” on page 52

General specifications

Table 12 lists the general specifications for the switch.

Table 12. General specifications

Specification	Description
Fibre Channel ports	32 FC ports universal (E, F, EX, FL, and M)
Ethernet ports	Two (2) 1000Base Ethernet ports for I/O synchronization during re-keying
Smart cards	Recovery card
Compression for tape	Hardware-based compression prior to encryption
Encryption	AES256-XTS block cipher core for disk encryption - IEEE 1619.1 compliant AES256-GCM block cipher core for tape encryption - IEEE 1619.2 compliant AES256-ECB block cipher core for third-party compatibility encryption support
Data Encryption Keys	Supports 64K Data-Encryption Keys (DEKs) - combination of disk LUN keys or tape pool keys
Re-key sessions	Supports 12 re-key sessions (outstanding) per switch. For a given target, supports a maximum of 2 concurrent re-key sessions - could be a combination of manual or auto (expiry based)
Crypto scalability	Supports 256 target devices, 1024 host ports (disk array target ports or tape target/library ports) per switch (quantity is double for two-way HA cluster configuration)
Crypto performance	Maximum bandwidth of 102 Gbps for disk I/O traffic; maximum bandwidth of 51 Gbps for tape I/O traffic
FC performance	Support for 1, 2, 4, and 8 Gbps SFPs which are full duplex capable
Certified maximum	6000 active nodes; combination of 56 switches, 19 hops; larger fabrics certified as required

Table 12. General specifications (continued)

Specification	Description
ISL trunking	Frame-based trunking with up to eight 8 Gbps ports per ISL trunk; up to 64 Gbps per ISL trunk
Aggregate bandwidth	512 Gbps per switch for non-encrypted traffic
Maximum frame size	2112-byte payload for FC
Classes of service	Class 2 (non-encrypted traffic), Class 3, Class F (inter-switch frames)
Data traffic types	Fabric switches supporting unicast, multicast (255 groups), and broadcast
USB	One USB port for system uploads and downloads, and firmware upgrades (supportsave, configUploads, configDownloads)
Fabric services	Simple Name Server (SNS), Registered State Change Notification (RSCN), NTP v3, RCS (Reliable Commit Service), Dynamic Path Selection (DPS), Advance Zoning (default zoning), Port/WWN zoning, broadcast zoning, NPIV, FDMI, Management Server, FSPF, Fabric Watch, Extended Fabrics, ISL Trunking, Advanced Performance Monitoring (APM), Adaptive Networking, Per data flow QoS, Ingress port rate limiting, Traffic Isolation, Group Management, Integrated Routing, and IPFC.

Management

Table 13 lists the management specifications for the switch. Refer to *Fabric OS Administration Guide* for more information regarding management of the switch.

Table 13. Management specifications

Specification	Description
Management	Telnet, HTTP, LDAP, Syslog, SCP, Auditing, IP Filtering, SNMP v1/v3 (FE MIB, FC Management MIB), Advanced WEB Tools, DCFM, SMI-S compliant, SMI-S scripting toolkit
Security and management	SSL, SSH v2, HTTPS, RADIUS, RBAC (Role-Based Access Control), DH-CHAP (between switches and end devices), port binding, switch binding, Secure RPC, Trusted Switch, change tracking
Management access	Serial port (RJ-45) and one USB port. Call-home integration enabled through DCFM

Table 13. Management specifications (continued)

Specification	Description
Diagnostics and supportability	POST and embedded online/offline diagnostics, including RAStrace logging, environmental monitoring, non-disruptive daemon restart, RCping and Pathinfo (FC traceroute), port mirroring (SPAN port), automatic trace dump transfers in support of FFDC (first--failure data capture), supportsave utility
Key management	Compatible with industry-leading key management systems, including IBM Tivoli® Key Lifecycle Manager (TLKM).

Size and weight

Table 14 lists the dimensions and weight of the switch.

Table 14. Switch dimensions

Dimension	Value
Height	2U = 86 mm (3.34 in)
Depth	635 mm (25 in)
Width	429 mm (16.88 in)
Weight (with two power supplies and no SFPs installed)	22.4 kg (49.4 lb)

Environmental requirements

Table 15 lists the acceptable environmental ranges for both operating and non-operating (such as during transportation or storage) conditions.

Table 15. Environmental requirements

Condition	Acceptable range during operation	Acceptable range during non-operation
Ambient temperature	0° to +40°C (32° to 104°F)	-25° to 70°C (-13° to 158°F)
Humidity	10% to 85% RH non-condensing, at 40°C (104°F), with maximum gradient of 10% per hour	10% to 90% RH non-condensing, at 70°C (158°F)
Altitude	0 to 3 km (9,842 ft) above sea level	0 to 12 km (39,370 ft) above sea level
Shock	20 G, 6 ms, half-sine wave	Half sine, 33 G 11ms, 3/eg Axis
Vibration	0.5 G sine, sine, 0.4 grms random, 5-500 Hz	2.0 G sine, 1.1 grms random 5-500 Hz
Air flow	129.1 cubic meters per hour (76 CFM) Maximum; 90.1 cubic meters per hour (53 CFM) Nominal	NA
Heat dissipation	1183 BTU/hr	NA

Power specifications

The power supplies are universal and capable of functioning worldwide without voltage jumpers or switches. They meet IEC 61000-4-5 surge voltage requirements and are autoranging in terms of accommodating input voltages and line frequencies. Each power supply has a built-in fan for cooling, pushing air towards the port side of the switch. Table 16 lists the power supply specifications for the switch.

Table 16. Power supply specifications

Specification	Value
Input voltage	100 - 240 VAC, universal
Input line frequency	47 - 63 Hz
System power consumption	285 Watts nominal

Data transmission ranges

Table 17 provides the data transmission ranges for different cable types and port speeds.

Note: The full range of 1, 2, 4, and 8 Gbps can only be achieved by a combination of 4 Gbps SFPs (1, 2, and 4 Gbps) and 8 Gbps SFP+ (2, 4, and 8 Gbps).

Table 17. Supported optics, speeds, cables, and distances

Transceiver type	Form factor	Speed	Multimedia (62.5 microns) (OM1)	Multimedia (50 microns) (OM2)	Multimedia (50 microns) (OM3)	Single mode media (9 microns)
SW	SFP	1 Gbps	300 m	500 m	860 m	N/A
	SFP/SFP+	2 Gbps	150 m	300 m	500 m	N/A
	SFP/SFP+	4 Gbps	70 m	150 m	380 m	N/A
	SFP+	8 Gbps	21 m	50 m	150 m	N/A
LW	SFP	2 Gbps	N/A	N/A	N/A	
	SFP	4 Gbps	N/A	N/A	N/A	
	SFP+	8 Gbps	N/A	N/A	N/A	N/A

Parts list (FRUs)

The parts in listed Table 18 can be replaced by a customer. Refer to Chapter 3, "Using and maintaining the switch," on page 31 for information on interpreting LED patterns and diagnostics and troubleshooting procedures to determine the status of components. Refer to Figure 1 on page 3 and Figure 3 on page 4 for the location of the parts listed below. Part numbers are subject to change, particularly for SFP transceivers. Contact your IBM representative for current information on part numbers for SFPs to meet your needs.

Table 18. FRU part numbers

Part number	Description
45W8655	Switch chassis assembly (replacement of chassis is required if internal circuitry fails)

Table 18. FRU part numbers (continued)

Part number	Description
45W3228	Power supply
45W0320	Fan assembly
45W8654	Smart card

For a listing of SFPs compatible with this product:

- Go to the IBM SAN products web page www.ibm.com/servers/storage/san/
- Select the product name from the displayed page
- On the displayed page, click the **Interoperability matrix** link in the **Learn more** section
- In the Interoperability matrix, navigate to the **Transceivers** section

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The following statements apply to this product. The statements for other products intended for use with this product will appear in their accompanying manuals.

Federal Communications Commission (FCC) Class A Statement

This equipment has been tested and complies with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits. IBM is not responsible for any radio or television interference caused by using other than recommended cables and connectors or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Industry Canada Class A Emission Compliance Statement

This Class A digital apparatus complies with Canadian ICES-003.

Avis de conformité à la réglementation d'Industrie Canada

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

European Union EMC Directive Conformance Statement

This product is in conformity with the protection requirements of EU Council Directive 2004/108/EC on the approximation of the laws of the Member States relating to electromagnetic compatibility. IBM cannot accept responsibility for any failure to satisfy the protection requirements resulting from a non-recommended modification of the product, including the fitting of non-IBM option cards.

Attention: This is an EN55022 Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

Responsible manufacturer:
International Business Machines Corp.
New Orchard Road
Armonk, New York 10504
Tel: 919-499-1900

European community contact:
IBM Technical Regulations, Department M456

IBM-Allee 1, 71137 Ehningen, Germany
Tel: +49 7032 15-2937
E-mail: tjahn@de.ibm.com

Germany Electromagnetic Compatibility Directive

Deutschsprachiger EU Hinweis:

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Zulassungsbescheinigung laut dem Deutschen Gesetz über die elektromagnetische Verträglichkeit von Geräten (EMVG) (bzw. der EMC EG Richtlinie 2004/108/EG) für Geräte der Klasse A

Dieses Gerät ist berechtigt, in Übereinstimmung mit dem Deutschen EMVG das EG-Konformitätszeichen - CE - zu führen.

Verantwortlich für die Einhaltung der EMV Vorschriften ist der Hersteller:
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Generelle Informationen:

Das Gerät erfüllt die Schutzanforderungen nach EN 55024 und EN 55022 Klasse A.

People's Republic of China Class A Electronic Emission Statement

中华人民共和国“A类”警告声明

声明

此为A级产品，在生活环境中，该产品可能会造成无线电干扰。在这种情况下，可能需要用户对其干扰采取切实可行的措施。

Japan VCCI Council Class A Statement

この装置は、クラス A 情報技術装置です。この装置を家庭環境で使用する
と電波妨害を引き起こすことがあります。この場合には使用者が適切な対策
を講ずるよう要求されることがあります。 VCCI-A

Translation: This is a Class A product based on the standard of the VCCI Council. If this equipment is used in a domestic environment, radio interference may occur, in which case, the user may be required to take corrective actions.

Japan Electronics and Information Technology Industries Association (JEITA) Statement

Japanese Electronics and Information Technology Industries Association (JEITA)
Confirmed Harmonics Guideline (products less than or equal to 20 A per phase).

高調波ガイドライン適合品

jeita

Korea Communications Commission (KCC) Class A Statement

Please note that this equipment has obtained EMC registration for commercial use. In the event that it has been mistakenly sold or purchased, please exchange it for equipment certified for home use.

이 기기는 업무용으로 전자파 적합등록을 받은 기기
이오니, 판매자 또는 사용자는 이점을 주의하시기
바라며, 만약 잘못 구입하셨을 때에는 구입한 곳에
서 비업무용으로 교환하시기 바랍니다.

Russia Electromagnetic Interference (EMI) Class A Statement

ВНИМАНИЕ! Настоящее изделие относится к классу А.
В жилых помещениях оно может создавать
радиопомехи, для снижения которых необходимы
дополнительные меры

rusemi

Australia and New Zealand Class A Statement

Attention: This is a Class A product. In a domestic environment this product might cause radio interference in which case the user might be required to take adequate measures.

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